THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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EXCESSIVE FREIGHT RATES.

COMMERCIAL men throughout the country have been reviewing with no small concern the continued increase in freight rates charged by British shipping companies during the past six months, when the conditions ruling throughout the commercial world have been entirely without precedent in history.

In justice to the shipowners, due allowance must be made for the difficulties caused by the serious reduction of ships available for mercantile purposes as a result of the heavy demands from the Government for vessels for transports. Due allowance must also be made for the all-round increase in the working expenses, particularly in the wages and coal bills. After making the most liberal allowances for these contingencies, however, there appears to be no reasonable justification for the abnormal increases in freight rates.

The rates for cotton goods have increased, in some cases, as much as 300 per cent. since the commencement of the war, while the charge for carriage of steel has risen from 10s. 6d. per ton, at which figure it stood just prior to the outbreak of hostilities, to no less than 50s. per ton, the present rate! The excessive rates demanded for carriage of foodstuffs have proved one of the most important factors in the bolstering up of prices to the present high level, and as a result of the inability of the railway companies to successfully cope with both the commercial and Government demands, the coastwise steamship companies have carried vast quantities of foodstuffs from one part of the Kingdom to another at practically whatever excessive rates they thought fit to demand.

If further proofs be needed that the rates charged during the past twelve months have been most exorbitant, the balance sheets published recently by British steamship companies will supply them at a glance. Profits as high as 80 per cent. on capital have been recorded on several occasions already, and at 60 per cent., or round about that figure, quite a number of hitherto comparatively modest dividend-earning steamship companies figure conspicuously, after having made the most liberal allowances possible for depreciation and renewals and repairs. Hardly a solitary exception can be found of a British steamship company which has not experienced phenomenal prosperity during the past twelve months, a success, it should be noted, that has been attained against the most adverse conditions arising from labour shortage, wages increase, costly fuel, and extra working expenses all round, and, moreover, on a total tonnage carried, in most cases far below that of a normal working year.

Whereas the German mercantile marine has been reduced to a state of utter ineffectiveness, in consequence of the inability of the German fleet to prevent the blockade of its coasts, the British steamship

companies have enjoyed, in a very large measure, the protection of the British fleet, and through this powerful agency have been enabled to reap a golden harvest. The burden of maintaining this great and powerful protector of our commercial welfare at the present high level has been quietly borne by the British public, and it must be considered a decidedly poor return for all the sacrifices made if this great weapon is to be used in the hour of need by the British steamship owners as a means to exploit the public, whose sacrifices and patriotism have enabled the shipping companies to prosper so exceedingly when they might reasonably have suffered a prolonged period of depression bordering on calamity.

The effect of such artificial impositions upon the trade of this country, both now and hereafter, is bound to prove of most serious import. From a strictly commercial point of view it is questionable if the shipowners can be seriously blamed for taking the opportunity to line their pockets at the public expense; and, doubtless, the argument they would at once adopt to justify their actions would be found to be based upon the law of supply and demand.

At a time such as the present, however, when restrictions and impediments abound on every hand to prejudice the smooth working of an accepted institution, the law of supply and demand cannot effectively operate without imposing unjust burdens upon one section of the community to the corresponding advantage of another. In the present case, the sections imposed upon comprise collectively the entire commercial interests of the country, and the results are too serious to admit of delay in their removal.

The Government doubtless owes much to the shipowners for the valuable services they have rendered at a critical period in the history of this country; the debt, however, which the shipowners owe to the British fleet for its protection is one on a far higher plane altogether and hardly comparable from any standpoint. In any case, the public and the commercial interests of the country cannot under any circumstances whatever be allowed to be imperilled by the obligations of either to the other, and the necessity for prompt action by the Government in the direction of fixing maximum freight rates is agreed upon by manufacturers and others throughout the country to be of the greatest urgency. There appears to be no reason why, in common with other sections of commercial enterprise which have been wholly or in part regulated and controlled by the Government, shipowners should not also be placed above the temptation to "make good" at the period when immunity from artificial restrictions and manipulations is most vital and most necessary to the commercial stability of the country.

A Commercial Electrical Association.

There has been a feeling for some time past among men who are interested in the electrical trade in various non-technical capacities that there is room for what might be called a commercial electrical association. We allude to men who take no interest in the Institution of Electrical Engineers, as it does not meet their particular requirements. They have been to a few meetings and "got tired" because they are non-technical men. Yet they want something more than an electrical sales managers' meeting society. It has remained for Mr. Howard Foulds to take the initiative in such a direction by making the suggestion public in an address to the Birmingham Electric Club, but he plans a far more ambitious scheme which might perhaps embrace the less pretentious one.

He propounded it in the course of a paper on "Organising the Electrical Industry," in which he pointed out that all of the existing associations and societies within the electrical industry are dealing individually with work which, as to the major portion of it, is common to all of them. He would like to see them amalgamated, Sub-Committees being appointed to deal with matters that were special to each of them. His argument is that these associations are wasting time and money by endeavouring to do something which separately they are not strong enough to carry out effectively, and he thinks that it would be infinitely better if there were some large association for the protection and development of the commercial side of the electrical industry, instead of "nearly a score" of smaller societies dealing with the matter. Those smaller societies will derive comfort from the knowledge that he sees good in all of them; they may not all readily agree with him that none of them is doing anything which has a sufficiently important result upon development of the applications of electricity to industrial and commercial uses. We believe we are correct in saying that the activities of the Electrical Development Committee are restrained owing to war conditions. We quote from his remarks:—

> We have nothing whatever to compare with the Commercial Gas Association, which organises a complete publicity crusade throughout the country and through the gas companies and gas departments of municipalities supports a very fine scheme of publicity.
>
> What I am really anxious about is that we should establish in our industry a body which shall be *prima facie* a commercial association. A technical institution we already possess, which does an enormous amount of valuable work, but we must have something far different if we are to meet the competition of the gas industry, and if we are to develop the employment of electrical methods. The nucleus of such an association already exists in the Manufacturers' Association, but we should require something more than this. We require, in addition, a strong association of supply undertakings, and one which will include the company as well as the municipal undertaking, because, commercially, there is no difference between the objects they have in view; and, further, we require a sound financial section, which will, if necessary, provide the funds for extending industrial undertakings.

As our banks do not support the trade of the country, Mr. Foulds regards it as the business of substantial industries to create their own financial institutions, and establish a body which shall be in a position to weigh up any propositions submitted to it, and provide the necessary financial backing. The financial position at the moment does not encourage us to hope for early support of British electrical industry along the lines adopted by industrial banks unless the industry itself plays a leading part. The proposition is, on this ground, a timely one for discussion. Among other objects of the proposed association Mr. Foulds mentions the training of young men to act as commercial and trade ambassadors in foreign countries, and do anything and everything which could bring the electrical manufactures of this country into full employment, not only within its borders, but also abroad. At this point Mr. Foulds has, in our estimation, touched one of the weak places in our electro-industrial armour. He at any rate does not think that we have reached the limit of our productivity. In his view none of the existing associations has a definite fighting commercial policy, while those which make some pretext of having it possess no means of prosecuting it. He recognises that some of the existing associations are of a nature that would prevent them from being absorbed by a commercial association, but he believes that many could be so absorbed, thus strengthening their influence, reducing their expenses, and saving a great deal of time. He holds that by securing the support of everyone in the industry, lay as well as technical, the association would be built upon a sure and solid foundation; that it would have such a huge membership that ample funds ought to be available for any progressive policy that was decided upon; and that the very existence of a powerful association of the kind would be a deterrent to any attempt in any quarter to interfere with the legitimate operations of the industry. For the purpose of discussion he advocates an organisation with three main sections, each having specialised sub-committees:—(1) Manufacturing and contracting; (2) Supply of electricity, including company and municipal; (3) Financial.

Mr. Foulds would like to see the new organisation take benevolent funds under its paternal wing and develop them, and he desires it to become so powerful an Association

that even the industrial apathy of Parliament could not prevail against it. We have witnessed the rise and fall of many schemes for the better organisation of our electrical industries, but as we indicated last week, the matter is still full of interest and importance and is a legitimate one for discussion. The proposal is one to remember. If it were not war-time it might stand a better chance of receiving the attention that it deserves.

Copper.

The copper market has shown increasing and sustained strength for some weeks, and, in spite of prices standing now at a higher level than since 1907, it would be altogether premature to assume that the upward movement has spent itself. The impelling cause, of course, is the ceaseless advance notified in America, where producers seem to have the position entirely in their own hands, and are able to raise their prices whenever orders of any magnitude are placed before them. The supply of immediately available copper in the United States is stated on all hands to have been reduced to trifling proportions, and, in view of this, there has been something like a scramble on the part of needy consumers who, having delayed purchasing, find themselves at last forced to enter the market for prompt supplies. The only conclusion which can be arrived at regarding the broad outlines of the situation is that the war demands are, in one way and another, licking up such a huge quantity of material, that the current output, large though it is, is insufficient to supply requirements. On the top of this there is a practical paralysis of the copper industry in the State of Arizona, where a strike has developed into a lock-out, and where the men are now showing a very nasty spirit, with the result that considerable damage has been done to certain of the properties. There is no relief in sight so far as the European market is concerned, although, if only some reasonable arrangement could be made in connection with the shipping of copper from America, there might be some relaxation of the difficulties. At the present time it is very hard for people here to buy copper, and still harder for them to ship it when it is purchased. Prices of refined copper are soaring, and, in spite of it all, the demand continues on a pretty good scale, although, naturally, the main consumption is that in connection with the supply of war materials. The shipments of refined copper from America to Europe continue small, but, to counterbalance this, the exports of brass and materials into which brass enters, show a large increase compared with last year.

Swiss or German?

It is remarkable to observe how the course of the war is tending to de-Germanise the directorate of that great investment and underwriting corporation bearing the title of the Bank for Electrical Undertakings (Bank für Elektrische Unternehmungen), of Zurich, whose annual report for 1914-15 was quoted at length in our issue of October 29th. When addressing the shareholders about a year ago, as was mentioned in this journal on December 25th, 1914, Dr. Julius Frey, the chairman, explained that the reason the Germans had a majority on the board—19 Germans against seven Swiss—was to be found in the historical development of the institution, and it would not be appropriate to remove deserving directors because of the displacement of shareholdings. It was incorrect to assert, the chairman added, that the bank was a German undertaking, as the decisive factor was the possession by Swiss of the majority of the shares. Apparently, however, to satisfy a section of the shareholders two additional Swiss directors were then elected to the board, still leaving the German element with a majority of 10 members. During the intervening period three directors have passed away, one of whom in the person of Emil Rathenau, as Dr. Julius Frey informed the shareholders at the meeting held on November 3rd, took the initiative in the formation of the bank, and had actively co-operated in bringing it to the position which it occupied to-day. We thus find confirmation of the statement made in this journal several weeks ago, that the bank owed its origin to the Berlin A.E.G. Another German, bearing the characteristic name of Commercial Councillor Deutsch, has been elected in substitution as the representative of Germany industry, whilst Herr Engster, chairman of the Oerlikon Machinery Works, and Herr Jenny, of Durst, have been chosen as representatives of the Swiss electrical industry. But probably the most important fact is that Dr. Julius Frey, who, a year ago, was in favour of the retention of the German majority, and who in conjunction with his Swiss and German colleagues consented to the addition of two further Swiss members to the board, has now agreed, together with his fellow-members, to a still further increase in the Swiss element by the election, which has just taken place, of five new Swiss directors of prominent standing. As one German member has now resigned and not been replaced, the final result is a board composed of 18 Germans and 14 Swiss. This further change has been effected in order to take into account in the composition of the directorate the actual conditions in relation to the distribution of the shares among the proprietors. Thus, although it was not thought advisable a year ago to remove deserving directors, the lapse of a year has so far brought about a change that the German element has now been diluted by the strengthening of the Swiss members of the board. At this rate of progress and bearing in mind that the majority of the shares are held by Swiss subjects, it is conceivable that the future may possibly hold out the prospect of the equalisation of the respective nationalities on the board, although the German financial interests would doubtless take precautions with the object of preventing any alterations being made which would place them in a minority.

Australia's Invitation to Trade.

The Report of H.M. Trade Commissioner for Australia (Mr. G. T. Milne), which we summarise elsewhere in this issue, brings home to us that Australia is as ready to buy from us as to fight for us, but it warns us that we on our side must be ready to offer as favourable trading conditions as our competitors are doing. The principle of giving substantial preference to British goods, in the absence of supplies of local manufacture, has been adopted by State and other public departments generally throughout the Commonwealth, and in every tariff revision there is a growing tendency to augment this preference. At no time in the history of Australia has there been so widely-expressed a desire to trade with the Mother Country as since the outbreak of war. It is clear, however, that British manufacturers, in order to profit by this invitation, will have to give more consideration to the matter of representation in the Commonwealth. A number of firms have given their views upon the relative conditions under which agencies for British and foreign manufacturers are held there, and they appear to justify the complaint which has sometimes been made that the conditions under which foreign firms appoint agents are more liberal, and freer from restraint, than those attaching to representatives of a British manufacturer. Mr. Milne's opinion, after sifting these views, is that British firms will be well advised to bear in mind that, in introducing a new line to a market where competition is keen, liberal treatment of a responsible representative may be that factor which will make for success, and that it may be bad policy to reject the terms of an agent because they appear to be high. Some of our firms at home do not realise that effective representation in Australia, where the distances between consuming centres are often very great, cannot be secured without considerable outlay. Several Australian firms have criticised the treatment their partners have met with, when making a business trip, from firms in the United Kingdom, in comparison with that meted out by firms in the United States or on the Continent. We well know that some of these pieces of counsel are very familiar; the pity of it is that they have to be repeated to-day.

AN AMERICAN MOTOR SEARCHLIGHT PLANT.

The use of motor searchlight plants in the European War has apparently caused the naval and military authorities in the United States to devote greater attention to such auxiliaries, as in the recent manœuvres at Plattsburg, near New York, considerable interest was shown in a machine recently completed by the Autocar Co., of Ardmore, Pennsylvania, and of which we are able to give some illustrations. The vehicle, which is designed not only to provide the necessary current for the searchlights—two in number—but also to transport the latter from point to point, is one of the company's 2-ton motor lorry chassis fitted with a body specially designed for its purpose, the sides being constructed of heavy steel plates in order to provide protection for the electricity-generating plant. Unlike many motor searchlight vehicles, in the Autocar machine the current-generating plant, as will be seen from fig. 2, is entirely independent of the engine which propels the wagon. It is carried on the floor of the vehicle, and comprises a horizontal two-cylinder petrol engine, having a bore and stroke of $4\frac{3}{4}$ in. × $4\frac{1}{2}$ in., direct coupled to a Westinghouse direct-current generator, designed to run at a speed of 1,200 r.p.m., at which it gives 56 amperes at 125 volts (7 kw.). The engine is fitted with a centrifugal governor, which regulates the speed within very close limits, and is furnished with its own petrol tank and independent radiator in connection with the water circulation system.

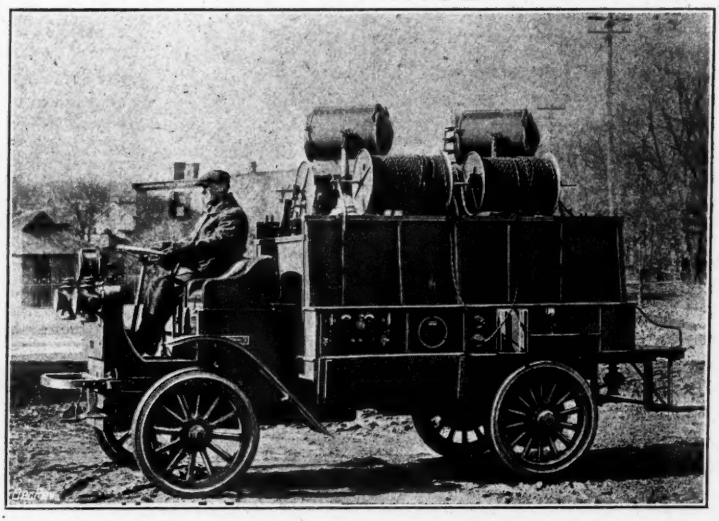


Fig. 1.—An American Motor Searchlight Plant.

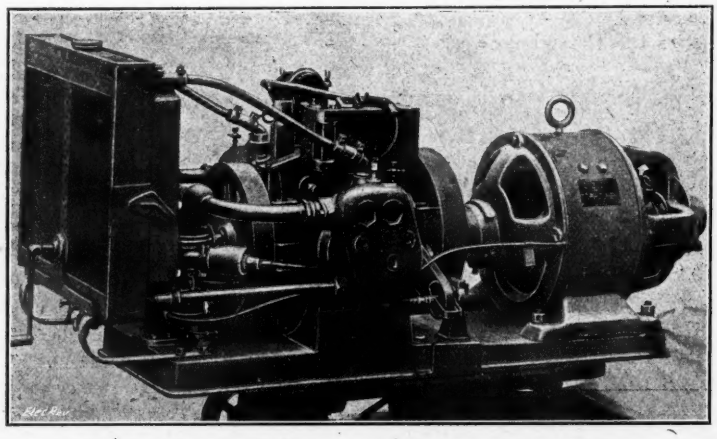


Fig. 2.—Petrol-electric Set for Motor Searchlight.

The searchlights are 14 in. diameter, and are each of 5,000 c.p. capacity, they being capable of projecting an effective beam of light up to a distance of a mile on a clear night. The searchlights are mounted on hand trolleys, so that they can, when necessary, be used some distance away from the vehicle on which the generating plant is carried. The trolleys, which are constructed entirely of steel and aluminium, run on a pair of spring-equipped cycle-type wheels, fitted with 28 × 3-in. pneumatic tires. They are light in weight and rigid in construction, and so designed that they have a large road clearance, enabling them to be used on very rough ground. Each searchlight is provided with 1,350 ft. of cable divided into two reels of 675 ft. each, so that each lamp can be operated independently of the other at a distance of a quarter of a mile from the generating plant, or half a mile from each other.

By means of specially-designed attachment plugs and reel arrangement, the lamps can be operated at any distance, within the limits of the cable, from the generating plant without it being necessary to unreel all the wire to get at the inner ends, the latter being arranged to pass through the heads of the reels, so that the attachment can be readily made. The necessary switches and cable connection plugs are contained in a cupboard formed in the near side of the body of the vehicle.

The machine has already been tested at the U.S. Marine Barracks, League Island Navy Yard, Philadelphia, by the U.S. Engineering Department at the Washington Barracks, and by the authorities of the Maryland State Militia, and is reported to have given very satisfactory results.

Fig. 3.—Motor Searchlight in Operation.

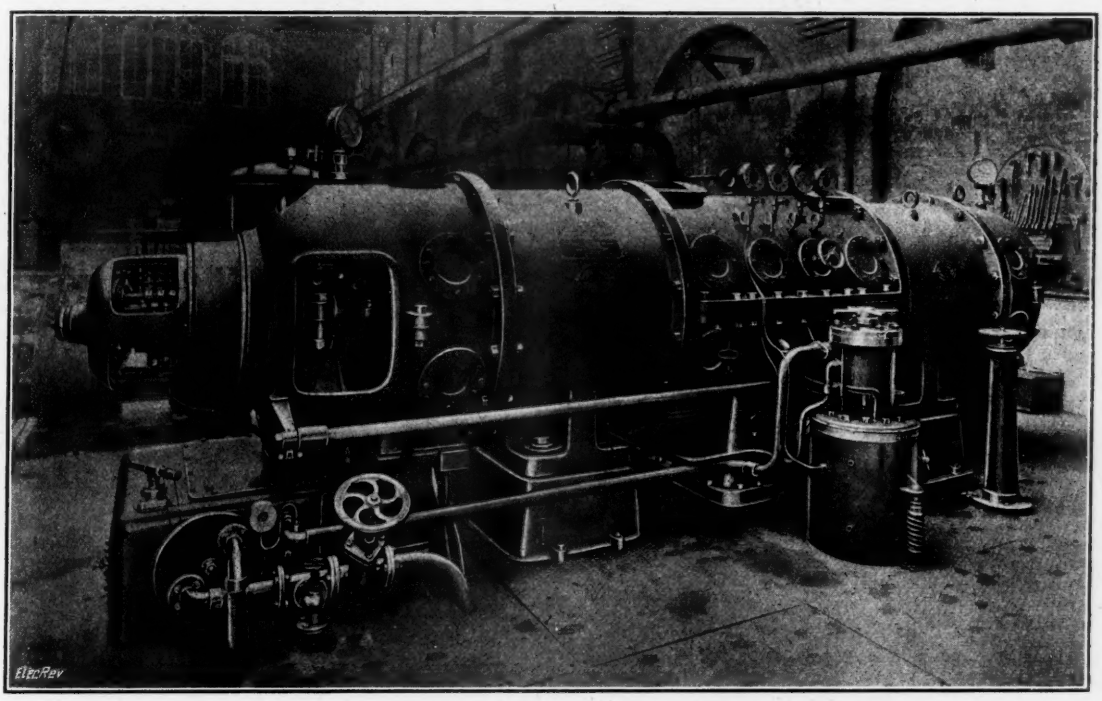
EXTENSIONS AT KETTERING ELECTRICITY WORKS.

In a recent issue we referred to the inauguration of a very considerable extension of plant at the electricity works of the Kettering Urban District Council. These works were started in 1904, and for the year ended March, 1915, generated some 2,228,000 units with a peak load of 1,100 kw. Kettering is a manufacturing town of over 30,000 inhabitants, whose staple trade is chiefly boot-making, though there are several large engineering works

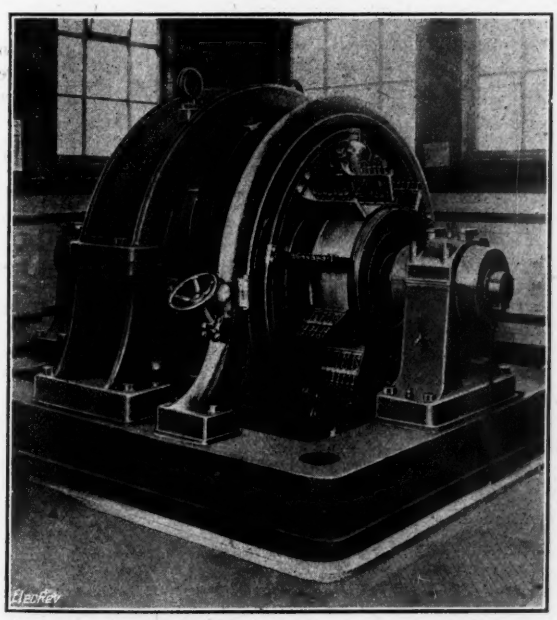
and clothing factories, and it is noteworthy that more than 35 of these factories rely upon the electricity department for their power, though this by no means exhausts the opportunities of the department in this direction.

The Council has full wiring powers, obtained under an Improvement Act, and has spent nearly £15,000 on assisted wiring schemes in the town. In the case of all motors installed under these schemes, the work is carried out direct by the electricity department, but house wiring is in nearly all cases carried out by contractors who are paid on a schedule basis. The latest plant extension was decided on in 1913, with a view to meeting the prospective requirements of the near future, and in the same year a contract was placed for the work. At that time the Council's generating plant consisted of a 460-KW. mixed-pressure Brush turbine set and a pair each of 315-KW., 150-KW. and 75-KW. sets, giving a total capacity of 1,540 KW.

The winter peak-load of 1912-13 reached 950 KW., and as the estimated peak-load for 1914-15 was 1,100 KW. (which was almost exactly attained), it was evident that a failure of the turbine set would leave the department in a difficult position. The supply up to that time had been on the direct-current system, and the electricity works are situated practically in the centre of the town with factories all round, none being further away than 1½ miles. The average factory load is about 100 H.P., and there has been no difficulty in obtaining the stated voltage at the different feeding points, so that it was decided to retain this system of supply.



Brush-Ljungstrom Turbo-Alternator installed at the Kettering Electricity Works.



1,200-KW. Siemens Rotary Converter, Kettering.

In considering the type of plant to be installed, Mr. Walker, the Council's electrical engineer, was to a great extent influenced by shortage of space at his dispoal, which rendered direct-current turbo-generators in tandem or a geared direct-current turbine set impracticable, and thus the choice was almost limited to the type of plant installed—viz., a turbo-alternator and converting plant.

In the selection of this plant, the Council, after considerable inquiry, decided to install a Brush-Ljungstrom turbo-alternator with condenser, &c., and a rotary converter to operate directly in conjunction with it.

The Ljungstrom turbine, as many of our readers know, is a departure from usual turbine practice, being of the radial flow double rotation type, with two turbine disks rotating in opposite directions, each disk being directly mounted on the rotor of its generator.

The Kettering turbine set is designed for a continuous output from its two generators of 1,265 KW., with steam at 150 lb. pressure at the stop valve. The alternators are three-phase machines, and the range of voltage at the direct-current terminals of the rotary converter is 460-540.

The steam consumption of the combined plant in lb. per KW.-hour at the direct-current terminals—the efficiency of the rotary converter being taken into account—is at a temperature of 500° F., full load 14·8, half load 16 8, and at 680° F., full load 13, half load, 14·8.

The efficiency of the rotary converter, which was made by Messrs. Siemens Bros. Dynamo Works, is at full load 95·5 per cent., at three-quarter load 95 per cent., and at half load 93 per cent. This machine, which is designed for a continuous output of 1,200 KW., and has an overload capacity of 25 per cent. for three hours, is directly connected to the turbo-alternators through an oil break switch, and is started up direct from them, taking three-phase 50-cycle current and running at 600 R.P.M.

The condensing plant for the turbine consists of a tubular surface condenser of 3,250 sq. ft. cooling surface, and will condense 20,700 lb. of steam an hour; it also was constructed by the Brush Co.

The air, water extraction and circulating pumps are of the Rees-Roturbo rotary type, direct-coupled to a 66-H.P. motor.

It may be mentioned that while the turbine set was duly installed to the specified time, the rotary converter was, unfortunately for the Council, commandeered by the authorities after it was packed up for delivery to Kettering, so that the winter load was actually met without the use of the new plant. A duplicate converter has been supplied by Messrs. Siemens, and the combined plant has been taking the entire load since the beginning of October, during which time the peak load has also reached the full load of the plant.

The main contractors were the Brush Electrical Engineering Co., Ltd., who have been responsible for the complete extension; the work has been carried out to the specification and under the supervision of Mr. W. A. Walker, the Council's electrical engineer, to whom we are indebted for the above particulars.

OUR TRADING OPPORTUNITIES THROUGHOUT THE WORLD.

(*Continued from page* 647.)

The Trade of Australia.

"No Room for Germans."

We have endeavoured to keep our readers accurately posted regarding the strong anti-German feeling that has existed in the Australian Commonwealth since the outbreak of war, and its very definite effect upon trade policy. Those who have studied the situation have noted the growth of such sentiment as new revelations of the treachery of the German character have been brought to light, and as the horrors of Prussian frightfulness have turned the blood cold. The attitude of our Australian brothers and sisters is reflected in the strong decisions of the Government to root out German influences from the metal and other trades, in the sweeping declarations that have branded firms "Enemy" in spite of their having works in England, and in the determined prosecution of those guilty of trading with "enemy firms." It is not for us to say how far there has been excess of zeal in developing this policy. The Colonies are quite capable of conducting their own affairs. They know the extent of the evil, and at close quarters are familiar with local circumstances and many things that we cannot expect to know. But such views as reach us here leave room for no misunderstanding. Whatever freedom they may have granted the German trader in the past—and they have to confess that they have welcomed him pretty cordially—they don't want to touch him or his goods with a long pole now, and they won't—*if they can get what the market wants from anybody else at a reasonable price*. They may put a thumping big tariff on goods from Germany and Austria in the future—it will have to be pretty big to be prohibitive for certain lines unless we change our ways and manage to manufacture more cheaply; they may buy from *or through* present neutral countries; but if their existing mood continues, the German importer will not be able to trade there without a mask, if there is a ghost of a chance of what the market needs being obtained from somebody else. Their desire is to produce their own manufactures if they can manage to do so economically. In a small way it has been tried for half a dozen electrical lines, but as things are, and are likely to be, the demand is too limited to assure a continuous production at acceptable prices. The new policy in regard to metal supplies may have a bearing on this aspect of the matter of Australian industry, but there is no reason for allowing this possibility to affect us in our efforts to supply the needs of the market. Having thus generally introduced the matter, we may get down to the details of the present position as they are set forth for our guidance in the report prepared by H.M. Trade Commissioner in Australia, Mr. G. T. Milne, for the year 1914. The report has just been issued by the Board of Trade, and we have selected such parts of it as we think should be of interest to electrical manufacturers, traders, and contractors:—

The General Position.

A review of the financial position of the country revealed conditions of exceptional strength, and, apart from the disturbing factor of drought, it is doubtful if any other country in the world was so well prepared to withstand the economic effects of war as Australia. The possession by a people, numbering about five millions, of gold reserves amounting to between £40,000,000 and £50,000,000 sterling is probably unique. The outbreak of war affected prices in lines of business where stocks were low. Local manufacturers have suffered inconvenience to some extent in obtaining supplies of raw or semi-manufactured material, particularly where they had been depending on Continental sources of supply, but importers generally are accommodating themselves to the new conditions, and goods formerly obtained from Continental countries now engaged in the war are being supplied by the United States, Japan, or the United Kingdom.

The following table shows the value of the imports in 1913 and 1914 of engineering and allied goods:—

	1913.	1914.
	£	£
Bar, rod, etc.; blooms, slabs, etc.; girders, joists, etc.	2,201,000	1,631,000
Galvanised plate and sheet	1,943,000	1,969,000
Pig and scrap	318,000	301,000
Machines and machinery (all kinds except agricultural)	4;789,000	5,076,000
Metals, manufactures of, dutiable	2,201,000	2,524,000
Railway material, rails, and fishplates	1,282,000	1,479,000
Tools of trade	651,000	609,000

German and other Competition.

Data for 1914 as to countries of origin are not yet available. In the five years ending November, 1913, the imports of manufactured merchandise in which the United Kingdom meets with competition from foreign countries have grown from about 40½ millions to about 60¼ millions sterling per annum, representing over 80 per cent. of the total imports.

The shares of the three countries chiefly interested in the import trade were as follows:—

	1909.	1913.
	£	£
United Kingdom	25,710,000	38,285,000
Germany	4,464,000	6,886,000
United States	4,135,000	7,125,000

These figures show how foreign competition has grown even in a market pre-eminently British in sentiment.

American Manufactures.

It is notable that, while imports of American manufactures have been steadily increasing from year to year, the sales of Australian produce in the markets of the United States have been relatively small. The latter is due partly to lack of direct shipping facilities, and also to the American import duty on wool and meat (now removed). On the other hand, the tonnage of vessels flying the German flag entered and cleared at Commonwealth ports, rose from 633,000 tons in 1905 to 1,211,000 in 1913. Favourable conditions of exchange having once been created, by the development of the German market for Australian wool and metals, the activity of German manufacturers seeking a market for their products has been intensified from year to year.

The German Government's part in this trade campaign has included: The appointment of official representatives to foster trade; low railway rates for export; co-operation between manufacturers and banking institutions, and also among the manufacturers themselves; export bounties.

German Efforts to Please.

In distributing their products, German manufacturers have not relied on such chance orders as might reach them through shipping houses in Hamburg, London, or other centres, but, by means of effective local representation in the Australian market, have been enabled to keep closely in touch with its requirements to an extent that would be quite impossible had they relied on shipping-houses only. When breaking new ground, they have displayed readiness to comply even with the whims of their customers; but of recent years they have not been quite so ready to abandon standardised forms as previously. The c.i.f. quotation has been featured more extensively by Continental firms than by British. The effect of the freight rates of British railways and British-owned steamship lines has been such as to involve loss of orders to our manufacturers. This condition will continue to operate adversely to British industry and commerce until the individual interests of the manufacturer and those of the railway company and shipowner are

brought into close co-operation. The success of German manufacturers has been contributed to by close attention to such details as packing, finish, and appearance, and by showing greater readiness than their competitors to sell goods on consignment on attractive terms. In heavy lines, *e.g.*, electrical machinery and railway material, lower prices, combined with a guarantee of quick delivery, have enabled them to secure a strong hold in the Commonwealth market.

Japanese and Neutral Activity.

The opportunity for capturing the Australian trade formerly done with Germany has been seized by the United States and other competitors. In industries where quick delivery of a given order may be essential, such as in the engineering and machinery trades, there is a likelihood that orders which under normal conditions might be placed in the United Kingdom will be placed with foreign manufacturers. The representatives of American, Swedish, and Japanese manufacturers have displayed increased activity since the outbreak of war. Even before then the United States might be regarded as Great Britain's most formidable all-round competitor in the Australian market. Now their share in the imports of machinery represents one-third of the total imports under this heading. Swedish manufacturers are exercising care in the selection of special representatives for the sale of their products, and are participating in the growing market for oil engines and other power plant. Their imports also include telephones, electrical fittings, and lamps. Japanese manufacturers are apparently determined to enter the Australian market for electrical machinery and appliances. Formerly their activities in the electrical trade were limited to porcelain insulators and a few glassware fittings; now they say they are ready to quote for motors, generators, transformers, water turbines, wires, and cables, as well as telephones and telegraphic apparatus, certain kinds of measuring instruments, and dry cells. They are issuing well-illustrated catalogues, some of which are printed in England with quotations in British currency.

Public Contracts.

Purchases of material and machinery by public bodies in Australia, whether Federal, State, or municipal, are usually made by tender, although in some cases purchase is by indent. When such is procurable locally, the term within which tenders are returnable is short, but when what is required has to be imported a longer term is generally stated. It is a matter of complaint among engineering firms, however, that in some instances the term stated is too short to enable the local agents for firms at home to communicate with their principals, except by cable. In the case of a lengthy specification this is impracticable. Most of the public departments are, however, willing to extend the term for returning tenders on proper representations being made. By far the greater number of public bodies in Australia adhere to the practice of having one of their own officers as sole judge in case of disputes. Contractors urge that such a provision is unfair, as it violates the principle that no one can be judge in his own cause, that it tends to restrict competition, and is thus contrary to the interest of the tax-paying community. The view of the Victorian Railway Commissioners is that long experience has demonstrated that independent arbitration has led to abuse by giving occasion to unjust and excessive claims. It appears doubtful whether the Commissioners will see their way to making the desired modification.

Representation.

For the manufacturer to rely exclusively on such orders as may reach him through shipping firms or merchants is to do himself and British industry less than justice, as while business can doubtless be secured by this somewhat passive method, its volume will compare unfavourably with the more direct, active method of local representation. Many manufacturers are deterred from making appointments of agents through the difficulty of securing the services of really reliable firms undertaking work of this kind. Where a large firm contemplates the appointment of an agent it will probably find that the best, and, in the end, most economical, course to follow is to send out one of its partners or responsible officers with full power to do what is necessary after investigating the market. It may in some instances be found advisable to send out a representative from the home firm to act as resident general representative, whose duties will mainly consist in the supervision of the agents whom he may appoint in the various States. In the case of small firms, who manufacture lines more or less closely allied, but which do not clash, it should be possible for them to co-operate in such a way as to secure jointly the benefits of local representation. Satisfactory arrangements for representation are often made with partners or responsible officers of Australian firms visiting the United Kingdom for the purpose of securing agencies, and discussing business policy with their principals in the agencies already established.

Firms communicating with the Trade Commissioner in regard to the appointment of an agent will save time, and facilitate the work of finding a suitable representative if they will indicate clearly the nature of the proposed agency, its scope, and duration, whether any business has been done with the Australian market through shipping houses in London, whether the manufacturer has been previously represented in Australia, and if so, by whom. Indications regarding the basis on which commission will be paid, and as to travelling and advertising expenses, catalogues and other trade literature will be helpful.

Treatment of Agents: The Old Complaint.

In order to ascertain what justification, if any, there is for the statement that British manufacturers are not so liberal as their foreign competitors in the matter of commission, travelling, and advertising expenses, etc., and in order to form a comparison of British and foreign methods regarding agency representation generally, the Trade Commissioner recently issued a circular letter accompanied by a schedule of specific inquiries. The replies received from several of the more important firms are summarised shortly below. The observation is still made that British manufacturers do not study local requirements so closely as their foreign competitors.

Commissions.—Most firms representing engineering and machinery manufacturers say that the commissions paid by Continental and American firms to their agents are, as a rule, higher than those paid by British firms. Foreign firms appear to offer larger discounts from their price lists where goods are sold to the agent outright, or on consignment, than do British. On the question of commission on indirect orders, the predominating practice with British and American firms is that the agent is covered. A machinery house, however, says that American and Continental firms do not readily agree to this; and another large engineering firm considers the treatment received from German and American firms in this respect is better than from British firms. More than one firm complain that their British principals hold that as they can themselves do business with the Agents-General of the Australian States in London, they are not obliged to pay commission to the Australian agent.

Travelling Expenses.—Both Continental and American firms are reported to be more liberal than British. The latter in many cases appear to make no provision whatever for travelling expenses to the agent, while the former in some instances allow £100 to £200 per annum. With regard to the allowance by the agent to his travellers, £1 per day, plus steamer and railway fares, appears to be usual.

Catalogues and Consignment Agencies.

The criticism of British firms under the heading of catalogues is well summarised by a large firm dealing in electrical appliances in the remark that, as a rule, Continental and American catalogues give more information about the goods than the British, and are more frequently renewed and brought up to date. Continental firms favour this form of agency more than either British or American. Continental firms are always ready to send consignment stocks, and go out of their way to look for business on the *quasi* basis, that is, to secure themselves by sending stocks out to be paid for when sold, and not later than, say, 12 to 18 months from date of shipment; again, they often send out goods amounting to a certain sum to be paid for against documents, and they duplicate the order or goods to an equal amount to be sent out on consignment.

(To be continued.)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Trade with Russia, and the Metric System.

Referring to your article "Decimal Coinage and the Metric System," the views of Englishmen abroad, who buy practically solely from home, may help a little in assisting you in bringing about a reform which is very necessary if we are to keep our position in the foreign markets, and not lose again the tremendous advantage which is at present ours—a desire on the part of foreign countries, allied to our cause, to make purchases in England.

As we are at present in Russia, our remarks will more especially apply to this country, where there is a market for all classes of machines and engineering specialities, besides other articles, of proportions little dreamed of at home.

Dealing with your questions in order:—

1. Yes! We employ the English system with England, metric system with Germany, France, Switzerland, and Scandinavia, and mostly with clients here, although the Russian measures are used in corresponding with places where there is a possibility of the metric system not being in force.

2 (*a*). Yes.
2 (*b*). Yes.
3. Yes.
4 (*a*). Most emphatically.
4 (*b*). Most emphatically.

The Change.—Anyone who has ever used the metric system for money or measures will affirm that the saving in labour is infinite, and the possibility of error greatly reduced. It is a fact that inability to handle our weights and measures and money loses hundreds of thousands of pounds of orders yearly to the old country, and during this period of the war, when so many firms here have been purchasing from England, we have been asked so often what is a "yard" that we have duplicated a list of English weights and measures and trans-

lated them into the metric and Russian systems and given them to clients.

It may perhaps help some readers to realise the difficulties of the foreigner if we give you a simple example of how a subtraction is made:—

Price, £5 12s. 7d.; discount (say), £1 16s. 11d.

This is the way a foreigner does it on paper:—

£4 31 19
£1 16 11
£3 15 8

Imagine the possibilities of error, and his efforts to arrive at the top line correctly!

Disorganisation Due to the Change.—The writer served part of his time in an English works, and went direct from there to a German establishment, and in less than a week was as much at home with millimetres as with sixteenths of inches. At that time the South of Germany had not quite forgotten the numerous sizes of inches that had existed, but no trouble was ever experienced in workmen adopting the metric system, and Englishmen will surely not say that they would be less adaptable.

Quoting in Foreign Money.—It is often stated that were manufacturers to quote in foreign money, they would practically become speculators on the rate of exchange. We have found that in normal times the rate of exchange varies so slightly that the variations balance themselves in the course of a year, and in the event of a large order, most banks are always prepared to give a forward quotation, relieving the manufacturers of worry on that head. If the Germans were able to quote in foreign currency, why not England?

Delivery.—English manufacturers quote usually franco works or f.o.b. English port, more often the former. In our experience we find it pays handsomely to quote delivered at the purchaser's mill, and we not only almost invariably obtain the order against a competitor quoting franco their works, but obtain a price much higher than the competing firm.

It may be argued that it is impossible for the manufacturer to calculate duties, cartage, freight, etc., but it is infinitely more difficult for the client, and he is less inclined to take the trouble when someone else (usually a German salesman) is prepared and willing to do it for him.

It is a simple matter to obtain quotations for freight to any port in the world from any place in England. Any shipping agent will quote.

Duties can be reckoned from the tariffs published in English; any clearing agent here will quote for clearing and delivering to any town, and anyone who would be prepared to go to the trouble would experience a pleasant surprise.

Of course, a live salesman on the spot will usually beat a quotation by letter, and therefore the most businesslike method of obtaining foreign orders is to appoint good agents, but they must be *good*.

A mistake often made by English firms is that they appoint an agent on the strength of his letter-head, without troubling to put him through an inquiry agency or making some inquiries as to his abilities to influence business.

Collection of Accounts.—English practice demands cash against documents at an English bank. This is extremely difficult for a foreign purchaser, and except that there is a slight delay in obtaining the actual cash, there is no disadvantage in collecting through a bank in the town where the clients reside, there being a sufficiency of first-class banks having branches everywhere.

Stamp Duties.—One of the details which cause a good deal of trouble here is the stamping of accounts. All accounts when sent out must bear the following duty stamps:—

When goods are purchased by retailers, 10 kopeks for every 100 roubles, say £10.

When purchased for own use, 50 kopeks for every £10.

These stamps, called Gerbovoie Stamps, may be purchased at any Consulate. If these stamps are not on the accounts we are liable to a heavy fine, and are precluded from annulling stamps ourselves if we put them on; and in any case, this would be a heavy tax on a reseller, as he has to pay the higher duty on his own accounts.

All firms in Germany before the war adhered to the regulations; but, with the exception of one or two, it is a custom unknown to English firms.

John A. Merrett,
Merrett & Jones.

Petrograd, *October 17/30th*, 1915.

Decimal Coinage and the Metric System.

Your very able article on the metric system of measurement is most interesting; but I fancy that, so far as manufacturers are concerned, you are preaching to the already converted. The difficulty does not lie with them, but with their customers, the general public.

In our own case, we have to keep two sets of figures in vogue. Lists and quotations have to be given in metric notation to customers in foreign countries, whilst another set of figures has to be employed in this country and the British Dominions overseas.

Naturally, we should be only too pleased to avoid this double work, apart from the waste of time to which you call attention in your article, resulting from our present incongruous assortment of weights and measures. But those into whose hands the goods ultimately come are used to *thinking* in terms of inches and pounds, rather than in millimetres and kilos, useless to them. No expression of opinion, therefore, on the part of manufacturers can ever result in the general adoption of the metric system in this country.

The only hope for such a salutary change appears to rest upon Government action, short of which nothing will prevent the average buyer from insisting upon the continuance of a system to which he has grown accustomed.

If, after a certain day, it were made obligatory upon all traders to sell only by metric measures, their customers would be forced to adapt their mental vision to these; and though a certain difficulty would naturally occur at first, it would be a small matter in comparison with the saving of time which would very quickly be effected. The difficulty would, moreover, be greatly discounted by the fact that, during the period of probation before the law came into effect, the public would have been forced to take cognisance of the new measures, and have accustomed their minds to grasping what they looked like in practice. Once this result has been achieved, and they are able to *think* in the new terms, there would be no further difficulty.

Chas. H. Elliot,
Managing Director,
The Associated Battery Co., Ltd.

London, S.E., *November 16th*, 1915.

An incidental advantage of the adoption of the metric system, which you are so ably advocating, and of a decimal coinage, whilch is its proper corollary, is the facility given for the use of adding machines, which type and sum any reasonable number of items without mental exertion, or need for checking, in a small fraction of the time taken by the most expert caster.

In one concern, known to me some 10,000 consumers' accounts, up to £2,000 wages and salary payments, and a large number of other receipts and payments have to be dealt with every month, the work including the dissection and allocation between various departments, and all the various revenue and capital accounts for the preparation of complete monthly balance sheets. Thanks to the use of metric measures and a decimal coinage all the casting of this mass of figures is performed by three adding machines, at a saving of time and clerical labour that is hardly calculable.

Similarly, the use of slide rules and logarithms is greatly facilitated. It is true that by decimalising our British measures and money such aids can be utilised, and, personally, I find it worth while to do this in the preparation of estimates, the summing and dissection of wages and costs sheets, etc., whenever a large number of items have to be dealt with; but the conversion takes time, has its own risks of error, and the processes are not readily checked or acceptable to auditors and others who stick to British ways. Of course, there are many accountants in our leading firms of auditors who are familiar with decimal methods, but they all want money values in £ s. d. when it comes to auditing.

It is difficult for anyone who has not worked with both systems to realise how much unnecessary mental drudgery and clerical labour is entailed by our measures and coinage. May your powerful advocacy help to bring about this much-needed reform.

Henry M. Sayers.

London, S.W., *November 16th*, 1915.

The Institution and Alien Enemy Members.

It is to be regretted that the President and Council of the Institution of Electrical Engineers have not seen their way clear to make known the attitude they intend to adopt with respect to subscribers to the Institution who are of alien enemy origin.

One can only imagine that the Council either is unmoved by the continued outrages and barbarities committed by our enemies, who week by week add further gruesome details to the same, or that the subtle influence which is known to have been at work to nullify the movement towards the exclusion from the Institution of members of alien enemy origin has been successful. It is hoped, however, out of respect to the hundreds of subscribers who are offering their lives for their country, that if the Council refuses to take the necessary steps (even if it needs a general meeting or plebiscite to amend the rules and regulations and by-laws of the Institution) to enable aliens to be removed from the roll of members, these brave men, upon their return, will refuse to continue to belong to an institution which has so failed in its duty to them.

Station Engineer.

The exclusion of men of alien enemy birth from the Institution of Electrical Engineers is a matter on which numbers of electrical engineers hold very strong views, and resolutions

have already been passed by representative bodies and forwarded to the Institution, but, judging from past experience, the Council may be expected to sit tight and let the agitation die down. Their position is a very strong one; in the ordinary course of events vacancies on the Council are filled by their own nominees, because, although great dissatisfaction is constantly being expressed at their policy, or want of policy, not only by individuals but by representative organs of the electrical industry, the opposition cannot be easily organised to make its weight felt. The only time that the Council of the I.E.E. took any notice of the wishes of the rank and file was when they wanted to increase the subscriptions. Then, and not till then, did the provincial members, who formed the largest proportion of the membership, get their long-standing grievances redressed. The application of that lesson is obvious: If all those members who resent the lofty disdain with which the Council regard any suggestions made to them will hold up their subscriptions (and the subscriptions can be held back for *two years* without loss of membership), then something is bound to happen.

This is quite a feasible method of protest, for, quite apart from those who want the German excluded, there must be hundreds who feel that it would do the Council good to be made aware that they are not irresponsible demigods, but the elected executive committee of the electrical industry in the British Empire, and that it is their duty to study and work for the interests of the profession which they represent.

There promises to be a severe commercial war between Britain and Germany, when Germany may be expected to use any weapon, however unworthy, and the revelations of German activity in the United States should open the eyes of the Council to the danger of allowing men of German birth in any way to influence the policy of the I.E.E.

It was stated on good authority recently that the proposal that members should write direct to the Secretary of the I.E.E., stating their views on this subject, was not feasible, for the German influence was so strong that large numbers in British manufacturing firms would be victimised if they expressed their views to their own Institution. If this is true, it is a scandal that should be righted at once. Perhaps those who can speak with first-hand knowledge would let us know through the columns of the Review if this is really the case, so that when January 1st arrives, and the subscriptions are due, there may be a large number who are ready to do their bit to compel the Council to put their house in order, and either act promptly, or, if their hands are tied, to take a secret vote of the members and carry out the wishes of the majority.

Another Station Engineer.

If anyone is confusing the issue, it is "Another Station Engineer," as my letter was a plea for standing by our obligations (in the form of "Scraps of paper") and for fair-play. In no possible way can my letter of October 26th be read as indicating "that naturalisation papers carry the right of membership of the I.E.E., and that expulsion from the I.E.E. carries with it the denial of British citizenship," and I must decline the honour which "Another Station Engineer" would confer upon me of deciding what does constitute the right of membership of the I.E.E., even for naturalised British subjects. My points are quite clear:—

(*a*) That we should honour "Scraps of paper" in the form or naturalisation papers.

(*b*) If the members of the Institution, after all, decide upon some action, that each case should be treated on its merits.

As an illustration, I may say that only to-day an elderly Lancashire man, who was caught in Germany when the war started and who was released last week as being of no military value, called in to see me with a message of goodwill from a German-born naturalised British subject, who was also caught in Germany at the commencement of the war and has been interned there, together with other German-born naturalised British subjects, ever since.

A.M.I.E.E.

November 15th, 1915.

Who Will Assist?

I am trying very hard to get a temporary position for a Belgian engineering merchant who had a large business in Antwerp, but fled with his family to this country prior to the German occupation.

He has had a good deal of experience in the sale of engineering and electrical specialities, and, in addition to having a first-rate knowledge of Continental commercial matters, he speaks English, Flemish, Dutch, and French.

I feel certain that with his experience and knowledge he should be able to find a position in one of the engineering establishments of this country.

I shall be glad to give complete details in regard to this gentleman, who occupies an unimpeachable position.

H. Scholey.

56, Victoria Street, S.W.

Electrically Heated Soldiers.

I saw an item of news in the *Daily Express*, this being copied from a German paper, and as a good many people are fond of apologising for the Germans, and saying what wonderful people they are, I thought that after reading this you would no doubt think the same thing, as I think that for costs of production of energy the "Point Fives" are quite eclipsed. It is no doubt interesting from one point of view, that if the Germans are applying this treatment to all their soldiers there will be no need for further fighting, provided they use a suitable heating element for the purpose of absorbing the power mentioned.

The paragraph is with reference to a type of clothing to be supplied to the German army, with wires interwoven with the cloth, and current supplied to these wires for the purpose of keeping the individual soldier warm. The paragraph reads as follows:—

"The heat may be regulated from 30 volts to 250 *kilowatts*, the cost of the apparatus being 8d. for each man, and the cost of working 1½d. per hour."

R. Falshaw.

Harrogate, *November 18th*, 1915.

A Contractor's Complaint.

I was interested to read the letter in your issue of the 12th from "J.S.L." He touches on a point which never appears to have had the attention it deserves.

I refer to the custom of giving full trade discounts off lamps to people who have no right at all to receive them. Your correspondent does not quite grasp the point, as it is quite in order for an ironmonger to receive trade terms. The basic principle underlying discount is that it should only be given to retailers who depend on their discount for their gross profit. Apart from retailing, trade discount has no meaning.

Whenever questions of discount arise, that is the point, and it is useless to confuse it by contending that only persons who have received a training in electrical engineering should be given discount, for we see exactly the same argument arising in the case of a great number of wholesale firms who give discounts to people who are not in the trade, and say that they do so because these people employ their own electrician, *e.g.*, picture palaces, large factories, etc. Of course, this is utter nonsense, as the lamps are not for resale, and it is this kind of nonsense that electrical contractors have been swallowing for some time.

The question is, what is being done? and I think it would be extremely useful to have a letter from a responsible member of the Electrical Association published in these columns, so that the ordinary mortal can have some idea of the attitude of the Association.

In regard to the second paragraph in your correspondent's letter, I must confess that I cannot hold him blameless if he allows his business to be snapped up by cycle agents: but why not mention the name of the wholesale house referred to? If we knew who it was, we could act accordingly.

A. W. Kimber.

London, W., *November 17th*, 1915.

[Our correspondent suggests that the point in question has never had the attention it deserves; he is evidently unmindful of the repeated and prolonged discussions on this subject in our "Correspondence" columns in past years.—Eds. Elec. Rev.]

The Tungsten Lamp Association.

A number of your correspondents have recently called attention to the fact that members of the Tungsten Lamp Association were furnishing incandescent lamps to the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd. The facts are as follows:—

By an agreement dated June 20th, 1913 (over a year prior to the outbreak of war) between the members above mentioned and the Allgemeine Elektricitäts Gesellschaft, of Berlin, the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., it was recited that an Order of the Chancery Division of the High Court of Justice had been obtained, dated May 21st, 1912, whereby, amongst other things, the validity of Patent No. 23,899* of 1904 was certified, and that the Allgemeine Elektricitäts Gesellschaft were manufacturing in Germany incandescent electric lamps and importing the same into the United Kingdom, which lamps, in view of said Order, were infringements of said patent, and in order to induce patent-owners to refrain from taking proceedings against the German company and its English offshoots it was agreed between the parties:—

(1) That the Allgemeine Elektricitäts Gesellschaft, the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., would not import into or sell such lamps in the United Kingdom.

(2) That the Allgemeine Elektricitäts Gesellschaft would pay damages for such lamps as had already been shipped into the United Kingdom (which damages were duly paid). And

(3) That the Electrical Co., Ltd., and the A.E.G. Electric Co., Ltd., would purchase from certain manufacturers in England such lamps as they might sell in the United Kingdom, which lamps the manufacturers agreed to supply.

So long as the laws of Great Britain remain as at present, these members of the Tungsten Lamp Association are bound

under said contract to supply to the above-named companies lamps for sale in Great Britain. Unless, and until, the law is changed, these members of the Tungsten Lamp Association are powerless to do otherwise than carry out a contract which the laws of Great Britain hold to be valid. This position is clear to any correspondent who is cognisant of, or refers to, the "Trading with the Enemy" Proclamation of September 9th, 1914, Clause 3, or the case of the Continental Tyre and Rubber Co. *v.* Tillings, and *v.* Daimler Co., decided by the Court of Appeal about February last.

W. C. Fisher,
Secretary, Tungsten Lamp Association.

London, E.C., *November 23rd*, 1915.

ELECTRICITY SUPPLY.

(*Abstract of inaugural address delivered by* Mr. C. P. Sparks, *President, to* The Institution of Electrical Engineers, *November 18th*, 1915.)

(I) Effect of Legislation.

No industry received earlier recognition by Parliament than that of electricity supply. Unfortunately, the advantages of encouraging private enterprise were disregarded. In the case of gas supply, after competition had been tried over a long period, monopolies were granted to private enterprise to supply gas over large areas, the price being controlled by a sliding scale connecting the price of gas and dividends. This method of operation has resulted in the greater part of the Metropolis being supplied by two gas companies representing the amalgamation of 19 smaller undertakings (the Gas Light & Coke Co. supplying an area in and around London of 125 square miles, from six main stations all supplied in bulk from the main down-river station at Beckton, 12 miles from the centre of the Metropolis). Under this method of control, gas is supplied at a low price, at the same time allowing the gas companies to earn such dividends that there has been little difficulty in financing the undertakings.

In spite of this precedent, Parliament in passing the Electric Lighting Act of 1882 decided that the unit of area in the case of our industry should be a parochial one. In consequence of this enactment, by the end of 1888 public supply was being given by only three companies under licences in Great Britain, and no supply was being given under any Provisional Order.

The effects of legislation in thus stifling the new industry in Great Britain were far-reaching. Our American and Continental competitors seized the opportunity to forge ahead in developing this new industry, which they had placed on a successful commercial footing. In the meantime, manufacturers in Great Britain, unable to proceed with the equipment of undertakings operating under statutory powers, had either to turn their attention to the equipment of separate works with lighting and power, or to operate without statutory powers by using overhead wires, permission for these being secured by private wayleaves of uncertain tenure. By this method of development the electric supply industry was started on unsound lines in this country, and the effects of this false start are still felt.

The Act of 1888 modified the Act of 1882 in four important particulars, but in spite of many efforts another 21 years had to elapse before further general legislation was secured.

It was not until 1908, when the companies obtained the right of association under the London Electric Supply Act, that the London County Council were constituted as the Purchasing Authority for the whole of the company undertakings in 1931, in substitution for the separate local authorities.

While immense trouble was taken in settling the method of supplying London in detail and in dealing with all local questions, the more important question of supplying London as a whole was disregarded.

(II) Electricity Supply in the Metropolis.

Unfortunately, owing to the legislation previously referred to, this area has been subdivided between so many electrical undertakings that the question of general supply cannot be considered from an engineering point of view. The present position arises through a series of initial mistakes, and future improvement is more a matter of adjusting numerous municipal and other vested interests than an engineering question.

Owing to the difficulty of co-ordinating the many separate interests created by the Acts of 1882 and 1888, and the fixed idea of our legislators that all interests were subservient to the interests of local authorities, no serious attempt to rectify this chapter of errors was made until 1904-5, when Mr. Charles Merz brought forward his epoch-making scheme to provide for the future electricity supply of this important area. The main outlines of this scheme were:—

The erection of three main power stations to supply the Metropolis—

(*a*) In bulk to the authorised undertakers then existing;

(*b*) Railways, tramways, and large consumers;

(*c*) Power in detail, and lighting up to 20 per cent. of the total supply to individual consumers.

A maximum price of 1½d. per unit; dividends on a sliding scale depending on the average price (the average price taken as ¼d. per unit, with a standard dividend of 8 per cent.); if the average price exceeded 1d. per unit no dividend.

While Mr. Merz succeeded in getting the Bill of the Administrative County of London Co. passed by Committees of both the Lords and Commons, finally securing during the inquiry the adhesion of all the companies and several of the important local authorities in the area, the great length of the inquiry left only three days for the final stages (usually formal) in the Commons. The activity of a few private members sealed the fate of this Bill and, notwithstanding the general benefits that would have resulted, the clock was again set back, certainly for ten years, the further expansion of the individual undertakings rendering the successful development of any complete scheme more difficult and more expensive each succeeding year.

Six years after the passing of the 1888 Act, ten supply companies were operating in the Metropolis, and it was not until these undertakings had been established by private enterprise that the local authorities, who had had it in their power since 1882 to secure perpetual rights to supply their own areas, commenced their operations; in fact, 12 years after the passing of the 1882 Act only one local authority was giving a supply in the Metropolis.

Progress during the first six years after 1888 was at the rate of 2.3 million additional units sold per annum; during the next ten years 12 million additional units per annum; and during the last ten years 20 million additional units per annum, although the use of the more efficient metal-filament lamp increased the light obtainable per unit more than threefold.

The density of the sales for general supply in the Metropolis, apart from those for traction, is now about three million units per square mile, 45 million units being used annually per square mile in the area of densest demand.

General supply is now being given in the Metropolis (an area of 117 square miles) by 38 separate undertakings, and traction supply by 10, there being 48 power stations, and 8 different frequencies of supply.

In view of the successful results obtained in this country outside the Metropolis by concentration and the recognised practice of the rest of the world in allowing one authority to operate over a large area from a minimum number of power stations, there is little to be said on the London question from an engineering point of view; but in spite of the extreme difficulty in carrying through any scheme dealing with the whole area, it is clear from the results obtained elsewhere that London will be divided eventually for electricity-supply purposes into a reasonable number of areas, even if a scheme embracing the whole Metropolis is not carried through.

The two main difficulties to be met when approaching this matter from an engineering point of view are as follows:—

1. Owing to the large sums invested by a number of separate undertakings in small power stations and special distributing systems, any comprehensive scheme must suffer a disadvantage in the first instance due to the added cost of—

(*a*) New high-pressure network, and

(*b*) Cost and loss in conversion plant.

From past experience distributing systems have been the only part of a supply undertaking which has not shown serious obsolescence, and there is now every reason to consider the return of the necessary expenditure in any new high-pressure network over a period sufficiently long to allow the undertaking to develop, rather than to look on the immediate result.

2. Reliability of supply is of the first importance and of far greater importance than the provision of a supply at a minimum cost. It is, therefore, argued that it would be unsafe to supply the Metropolis from a few stations, special objection being taken to any scheme which commences by adding one new power station of considerable magnitude.

It will be agreed that adequate safety can be secured with far less than the present number of power stations (38 in number), and as most of the individual undertakings are being supplied by a single power station unconnected with any other undertaking, the general safety of supply would be improved if the separate undertakings were inter-connected and supplied from a suitable number of modern power stations, each capable of dealing with demands of not less than 100,000 kw. A commencement could be made with one station to supplement the supply from existing stations, and as the less efficient of these passed gradually out of use the main power station would be supplemented by a second or further stations as required.

Apart from public advantages of a co-ordinated supply working in the direction of a unified system with standard pressures of supply and of the cheapening of plant owing to the greater demand for standard apparatus, and also of the lowering of the price per unit, there are two main factors that render a scheme of consolidation of the first importance, namely, economy in fuel, and the removal of power stations from the more densely populated areas.

(III) Main Engineering Features.

Many inventions of value have resulted in improving the reliability of supply and in greater economy of production. The development of three-phase transmission, with resulting economy in first cost of generators and mains, the ease of transformation, and the invention of the induction motor,

provided a system which enabled one undertaking to serve every class of demand in a large area.

The original alternating-current systems in this country were started for lighting supply, and consumers were supplied through overhead wires by separate transformers. To keep down cost and to raise the efficiency, frequencies of 80 to 100 cycles per second were selected. The choice of these high frequencies made the development of single-phase alternating-current motors almost impossible.

Although 50 cycles has now been adopted as the standard frequency of supply for all purposes outside special transmissions or single-phase railway work, the effect of developing A.C. systems on a wrong basis has not yet been eradicated.

The general parallel working of alternators was a matter of difficulty up to 1889, and at that date all the alternating supply companies in this country operated with alternators supplying separate groups of feeders. No material progress was made in the operation of alternators in parallel as standard power-station practice until after Mr. W. M. Mordey laid down the principles and demonstrated the theory by the practical parallel working of the alternators of his design. This pioneer work of Mr. Mordey at once had a far-reaching effect on power-station design and methods of working. It improved the reliability of the supply and lowered the operating cost by enabling the running plant to be worked at its most economical rating; it also showed the possibility of converting single-phase alternating currents into continuous currents by the use of synchronous motor-generators.

The development of the steam turbine, due to Sir Charles Parsons, together with the adoption of superheated steam and suitable condensing facilities, has entirely changed the character of supply undertakings. It has enlarged their scope by increasing the possible size of operating units, has greatly reduced the first cost of generating and boiler-house plant and buildings, and has lowered operating cost. The maximum size of turbo-generators is not yet in view; machines rated at 30,000 and 35,000 KW. are at work, while machines of still larger capacity are being designed. The upper limit in the size of generators is at present fixed by the extent of the system to be supplied and the limitations of the method of control, rather than by any limitations in the design of the turbine or electric generator.

The main improvement in steam-raising is the universal use of large boilers of the water-tube type, combined with superheaters and mechanical stokers using small coal of medium calorific value, as compared with small boiler units of various types, hand-fired with coal of high calorific value.

Large power stations now use boilers in which the superheater and economiser form an integral part of the boiler, each boiler on normal output evaporating up to 50,000 lb. of steam per hour at 200 to 250 lb. per square inch pressure, the steam being superheated 200 to 250 deg. F., as compared with boilers evaporating 8,000 to 10,000 lb. of steam at 80 to 150 lb. pressure.

The average efficiency in conversion of the heat energy of the coal has been raised from 65 to 85 per cent. on test and from 50 to 75 per cent. under operating conditions, with a material saving both in the cost of fuel and in labour. Also, due to mechanical stoking, boilers now give their full output efficiently and continuously for long periods, compared with the fluctuating output in the case of hand-fired boilers due to the necessity of cleaning fires. This factor is of prime importance in reducing the amount of boiler power required. Again, the use of small coal enables the entire coal supply to be handled mechanically, and the development of the suction ash-conveyor has reduced to a minimum the amount of labour required in the boiler house.

As a result of the improved thermal efficiency of the boiler house and resulting low temperature of the gases, mechanical draught has become a necessity, the old difficulties of induced-draught plant, due to action of the hot gases on the fan and casing, not occurring with the lower temperature at which the gases are now discharged from the boiler.

The decrease in the number of operating units and the simplified steam range have directly reduced the stand-by losses in the boiler house and steam piping.

The increase in size and the improved design of water-tube boilers and accessories have resulted in the space occupied by the boiler-house plant being reduced to one-fifth of that required for an equal evaporation of steam 30 years ago.

The invention and development by Mr. Ferranti of the paper-insulated lead-covered cable has not only reduced the cost of transmission and distribution, but has largely increased the reliability of operation. Almost all transmission cables are now paper-insulated, lead-covered, armoured, and laid direct in the ground; while for distributing purposes in the more central areas, paper-insulated lead-covered cables drawn into conduits are largely used. When it is considered that some 40 per cent. of the capital outlay in the electric supply business is due to distribution, of which the cost of cable represents the greater proportion, the importance of this development is apparent.

The development of the 50-cycle rotary converter has resulted in reducing the space occupied by transforming plant to one-half of that required by motor generators; the first cost has been reduced to between one-half and two-thirds, and the efficiency of conversion has been raised to 94 per cent. at full load.

The metering of electricity was a great difficulty in the case of early undertakings. The first meter developed for continuous-current supply was of the electrolytic type. No meters were available for alternating-current systems, and electricity was sold by annual contract.

Initially, the development of the continuous-current meter appeared to be a simpler problem than the metering of alternating currents. Now all alternating-current meters are of the motor type worked on the rotary-field principle. The absence of commutation and of collection of current has proved an enormous advantage in maintaining their accuracy, and more difficulty is now experienced in maintaining the accuracy of the D.C. meter over a given period than with the A.C. type.

No method of metering energy has been brought to greater perfection than that for the metering of electrical energy, and the ease and accuracy of measurement have played a great part in enabling losses to be analysed and improvements made by increasing the efficiency of apparatus and the operation of the system.

As an instance of close calibration and accuracy over a considerable period, I give the reading of three motor meters, the power factor of the supply varying from 0.8 to unity and the demand from 2.5 to 60 per cent. of the rated capacity of the meters.

	Meter (1)	Meter (2)	Meter (3)
Number of units registered	1,955,700	1,945,800	1,952,300
Mean reading—units		1,951,266	
Error from mean—units ...	+ 4,434	− 5,466	+ 1,034
Error from mean—per cent.	+ 0.23	− 0.28	+ 0.05

The introduction of the metal filament resulted in increasing the C.P.-hours derived from one unit of electricity threefold, to 800 C.P.-hours per unit, lamps of small C.P. being manufactured for pressures up to 250 volts. The recent development of incandescent lamps with nitrogen-filled bulbs has again more than doubled the number of C.P.-hours obtainable per unit, the figure now being 2,000. These improvements in the efficiency of incandescent lamps have resulted in increasing the standard of illumination and have largely increased the use of indirect lighting.

Although the number of units sold by some supply undertakings showed a marked decrease when metal-filament lamps were first introduced, the lowering of the cost of illumination at once resulted in increased business, which, owing to the growth in the number of consumers, has placed the supply undertakings on a more secure foundation.

Another important result of the introduction of the metal-filament lamp is that, owing to the high temperature at which the filament is worked, it is much less sensitive to fluctuations in pressure.

This characteristic of the metal-filament lamp, added to the absence of the blackening of the bulb, has much improved the quality of the lighting and has materially reduced the difficulties met with during the hours when the distributing network is heavily loaded.

The high efficiency of conversion from electric to mechanical power in the motor as originally developed left little room for improvement. The main efforts of designers have been devoted to reducing the weight and thus lowering the first cost, which has fallen 50 per cent. in motors of moderate size during the last 15 years. The other direction of advance has been in improved reliability, reducing the cost of maintenance.

Little further improvement can be expected in efficiency, which, for motors of moderate power, speed, and voltage, reaches 85 per cent.

(IV) Direction of Further Progress.

In the light of our present knowledge there are four main reasons why we should expect a large further expansion in the general supply, apart from the extension of electric traction and the use of electrical energy for electrochemical purposes. These reasons are as follows:—

(1) Necessity for fuel economy.
(2) The extension of lighting.
(3) The increased range of transmission.
(4) Domestic use of electricity.

(1) The economical use of fuel has been hindered in this country by its low price. Only a fraction of the total coal consumed is at present used for centralised supply of power and heat; the principal future economy in fuel is to be found in increasing the use of such centralised supply to allow the most efficient use to be made of the world's coal supplies. To attain this economy, large capital outlay is required on plant for converting the heat energy of the coal into electricity; but the present apparently lower cost when using fuel inefficiently at a large number of isolated points, retards progress in the direction of centralisation, as immediate results are often only considered.

The fuel-saving by using a centralised supply is due to the reduction of stand-by losses and to the higher efficiency of large generators and boiler plant when worked under skilled supervision. The fuel-saving under average conditions from a central scheme as compared with isolated plants is not less than 75 per cent. With the gradual increase in the cost of fuel, it is unquestionable that all main supplies for power and heat will be obtained in the future from centralised sources.

One of the next steps to lower the cost of production of electricity will be the gas-firing of boilers, the gas being obtained from producers worked at a low temperature. This will provide by-products from the distillation of the coal as a raw material for other industries. The sizes and positions of

most of the present power stations prevent this system being used, as by-product processes can only be successfully worked on a large scale and with plant operating at a high load factor; but the increase of electrical energy taken from centralised sources of supply and the gradual change from comparatively small stations to main power stations, will allow of this method of generation.

(2) Apart from hygienic reasons, it is certain that electricity will prevail more and more as an illuminant owing to the greater number of C.P.-hours that can be obtained from a ton of coal by using electricity as compared with gas. With electricity generated in modern power-houses using 25 B.TH.U. per watt-hour, and with 85 per cent. efficiency of distribution, the number of C.P.-hours obtained per ton of coal is, with metal-filament lamps of 15 to 20 C.P., no less than 750,000, as compared with 260,000 in the case of gas, gas mantles of 20 C.P. and 13,000 cubic feet of gas per ton of coal carbonised being assumed. The amount of coal required with electricity for small units of light is thus only one-third of that necessary for an equal illumination with gas.

It may be suggested that further improvements in the gas mantle will equalise matters; but it must be remembered that electricity is more than holding its own in new developments. The half-watt lamps now on sale have again reduced the energy per C.P.-hour by more than 50 per cent. for lamps of 120 C.P. (smaller units of light being available when lower pressures than 100 volts can be obtained by transformation).

(3) Further research should result in improved dielectrics which would allow higher working pressures for underground cables, thus lowering the cost of transmission, increasing the size of each centralised undertaking, and again raising the operating load factor by the greater diversity in the demand.

Pending this development, the economical radius of transmission can be increased by using overhead lines outside the thickly populated districts, and it is not too much to expect legislative action in the national, as against private, interests. Statutory powers should allow the erection of transmission lines along the most economical routes, reasonable rents for wayleaves being fixed by an independent tribunal.

(4) There is no section of the general supply that opens up greater possibilities than electric cooking and heating, since at a low estimate the units required for these purposes would be ten times those required for lighting. This development would utilise to much greater advantage the distributing mains in residential areas, which are at present only fully loaded during a few hours per annum.

While the efficiency of conversion in the present electrical apparatus is high, and the system is an ideal one hygienically since there are no products of combustion, development has been slow for the following reasons:—

(1) With the present method of conversion of the heat energy in the coal to electricity it is only possible to deliver to consumers some 15 per cent. of the heat energy in the coal.

(2) The present cost of the apparatus and its maintenance. A large expansion of business would enable manufacturers to meet this point, and immediate improvement will take place as soon as the supply undertakings are prepared to let on hire and maintain apparatus on liberal terms in the same manner as the electric motor business was developed.

(3) The rates charged for this class of supply are in many cases not sufficiently low to encourage development. A low rate is essential and is justified by the high diversity factor and the large number of hours of use, resulting in a greatly improved load factor from the residential demand.

WAR ITEMS.

New Sources of Copper for Germany.—The mineralogist Oebbeke, of Munich, has called attention to the presence and possible working of copper ores in the Bavarian Rhine Palatinate, and the "E.T.Z." states that this matter will receive energetic attention. There are also rich copper fields in the parts of Serbia newly conquered by Bulgaria, in the Morawa district. Ironically enough these mines have been worked for some years by French and Belgian capital; the copper output is said to be 20 to 30 tons daily. With the opening of the road to Constantinople, the Germans hope to be able to import considerable quantities of copper from Asia Minor, and it is claimed that the Arghana-Maden mine at Diarbekir will supply practically all the enemy's requirements. This mine is the richest in Turkey, and one of the most productive in the world; and there are valuable deposits in many other vilayets of Asia Minor. Many of these deposits have not been worked to maximum advantage in the past, and if their total production be insufficient to meet the normal demands of Germany, it is at least so great that copper famine does not seem likely to contribute appreciably to the enemy's defeat.

Reuter's agent at Copenhagen says that the copper famine in Germany is reported to be reaching an acute stage. A number of churches have received polite but firm requests to hand over whatever copper may be in their possession. The great Cathedral at Bremen, by way of showing a good example, has placed all its available copper at the disposal of the military, even its huge copper roofs, which are now being dismantled.

A newspaper report states that Germany is getting seventy tons of copper daily from the Serbian mines.

Russian Trade.—In a very valuable report on the measures needed for increasing French trade in Russia, which appears in the "Bulletin de la Société d'Encouragement pour l'Industrie Nationale" (pp. 107-146, July-August, 1915), it is pointed out that, in the electrical trades, a great lever on behalf of German trade is supplied by the standardisation rules for electrical machinery, etc., set up by the Deutsche Electricitäts Verband, which are in use generally throughout Russia. To remedy this disability, it is suggested that the rules of the Union des Syndicats d'Electricité Française should be substituted, and that energetic representations should be made to the Russian Association to this end. The diplomatic support of the French Government is also called for. The matter equally interests British manufacturers, and it would be well, at an early stage of the proceedings, for the British electrical industry to join forces with the French, in order that an arrangement may be come to serviceable alike to our own needs and to those of our Allies.

The "Times" correspondent at Petrograd states that the Council of Ministers has approved a proposal of the Minister of Finance to suspend the remaining commercial and industrial enterprises of enemy subjects in Russia, at present numbering 1,102, employing 32,208 hands, with an annual turnover of £10,633,488.

The Russian Ministry of Commerce has drafted a Bill with the object of exterminating German influences in the electrical industries of Russia. The Bill provides that concessions for electrical undertakings shall be granted in future by the Ministry of Commerce instead of by the Communes as hitherto.—"Ironmonger."

Starred Men.—Lengthy lists have been issued of scheduled occupations which the Authorities consider vitally important in connection with the munitions and industrial operations during the war. In list "A," which sets forth "occupations required for production or transport of munitions supplied by Ministry of Munitions," we find the following:—Electric welder and cutter; wiremen (building or shipbuilding), electrician (ship), armature winder; electrical instrument makers; scientific instrument makers. In list "B" (coal-mining), all classes of underground workers are included, and colliery electricians (above ground). In list "C," among the railway employés, telegraph wiremen are mentioned; and electricians employed in the "Screener (coke-screener), shale burner and shale mining" class are listed. List "D," which relates to reserved occupations of cardinal importance for the maintenance of certain branches of trade or industry, includes:—"Electricians engaged in maintenance and repair of tools and machinery (all trades)—electric light and power supply (public utility services, gas, electric light and power corporations, tramways, waterworks and canals). For the detailed lists we would refer our readers to the daily press for Monday and Tuesday last.

German War Allowances.—The Main Kraftwerke A.G., Hochst a.M., is paying members of its staff who have been called to the Colours 50 per cent. of their normal wages, plus 5 per cent. for each child, up to a maximum total of 70 per cent. of full pay. The families of workmen, wiremen, etc., are receiving 7 marks a week, plus 1½ marks for each child, up to a maximum total of 12 marks (1 mark used to equal 11¾d.). The company continues its contributions to the sickness insurance fund. War bonuses are paid to men still employed, on the following basis:—7½ per cent., plus 2½ per cent. for each child, up to 15 per cent. total, for married men normally receiving up to 250 marks a month; 5 per cent., plus 2½ per cent. for each dependent, up to 12½ per cent. total, for single men receiving up to 150 marks a month.

The A.E.G., Berlin, has granted its married employés earning 300 marks, or less, per month a bonus of 50 marks on account of the rise in prices. Single employés in the same wage class receive 25 marks bonus.—"E.T.Z."

Arming Disabled Soldiers for the Industrial War.—The Verein Deutscher Ingenieure (German Society of Engineers), of Berlin, is organising a competition for the best design for an artificial arm that will enable a man who has lost an arm to do engineering work. Prizes to the extent of £750 (the first one being £500) are being offered in connection with the competition, which will close on February 1st next.

Australia and German Trade.—A Reuter dispatch from Melbourne states that the Federal Government has suspended all enemy trade-marks.

Mr. Hughes, in replying to a deputation which urged increased tariff protection against the dumping of cheap German goods after the war, said:—"If we have the power we shall take steps to prevent German goods from coming here after the war."

War Profits.—The Minister of Munitions has appointed Sir Henry Babington Smith, K.C.B. (chairman), Mr. Harold Brown, and Mr. William Cash to be the Board of Referees relating to the limitation of the profits of controlled establishments.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Industrial Fittings.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have recently issued a supplementary pamphlet, No. F 1964, dealing with industrial fittings, including various vitreous enamelled half-watt lamp fittings, Benjamin and Holophane reflectors, &c., and sundry heating apparatus suited to industrial use.

We illustrate in fig. 1 a G.E.C. "munition" shop pendant, consisting of an 18-in. enamelled steel top reflector with an opal bowl underneath, the fitting being suited to the 200 to 500-watt sizes of Osram Atmos type (half-watt) lamp. Fig. 2 represents a G.E.C. Benjamin semi-indirect half-watt lamp fitting, constructed in sizes suitable for from 100 to 1,000-watt lamps with 16-in. and 20-in. top reflectors; while fig. 4 is a shell inspection hand lamp, designed especially for the examination of shell interiors. This is supplied in two sizes, 18 in. and 24 in. in length; the handle can be fitted with a switch at slight extra cost.

Fig. 1.—"Munition" Shop Pendant.

Fig. 2.—Semi-indirect Half-watt Fitting.

A series of Holophane industrial reflectors of the "extensive," "intensive" and "focusing" types for half-watt lamps of from 60 to 1,000 watts are listed.

Monometer Tinning Furnace.

The usual method of coating wire with metal is to draw the wire through an open pot containing the molten metal, the very considerable loss through surface oxidation being accepted as inevitable.

In a system introduced by the Monometer Manufacturing Co., Ltd., of Whitehouse Street, Aston, Birmingham, the special features comprise a complete enclosure of the melting pot, means for the prevention of oxidation of the molten metal, a self-acting heat controller for maintaining the metal at the correct fluidity, a system of heating by low-pressure gas which produces intense heat without fans, blowers, or compressors, and ensures perfectly uniform distribution of the flame and heat, special guiding devices for the wire which enable it to be rapidly threaded on to the guide rollers, and the elimination of fumes. The last feature was the motif for a recommendation by H.M. Chief Inspector of Factories.

The body of the furnace is strongly constructed and supports the melting pot, which is covered by an enclosing dome-shaped casting, forming virtually a sealed chamber for the melting operation. This chamber is supplied with inert gases from the Bunsen burners under the melting pot, so as to produce an oxygen-free atmosphere, and the experience of many users of this system proves conclusively that the saving in residue effected amounts in many instances to not less than 4s. per ton of metal melted.

Another factor in reducing the dross formed, is the automatic temperature controlling device, which operates on the thermostatic principle, and is so constructed and arranged that immediately the metal has attained the required fluidity, the supply of the burners is cut down and the temperature of the molten metal kept constant. In wire coating this is a most important point.

The patent gas burner system comprises any desired number of Bunsen burners fitted to an equalising chamber, which distributes uniformly the volume and pressure of gas supply to the individual burners, the latter themselves having a peculiar internal construction which produces an intense heat with a remarkably low consumption of gas. The gas supply pipe is simply connected up to the ordinary town gas main.

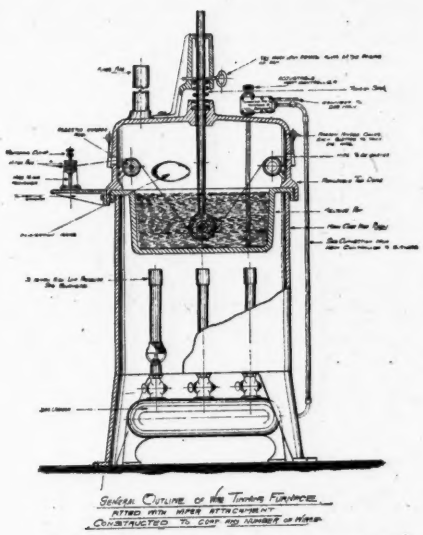


Fig. 3.—Monometer Tinning Furnace.

Within the melting chamber and above the melting pot are arranged a series of guide rollers over which the wire is run, the lowermost rollers being mounted on slidable rods individually adjustable in order that the rollers may be moved to facilitate threading of the wire. A novel point is the spring control of the rollers when in the active position, which substituting resilience for rigidity almost eliminates the possibility of wire breakages. As the wire leaves the molten metal it encounters a fixed wiper so positioned as to direct the drips back into the melting pot, the final wiping device being outside the melting pot and having the wiping blocks readily adjustable in respect of the pressure exerted on the wire.

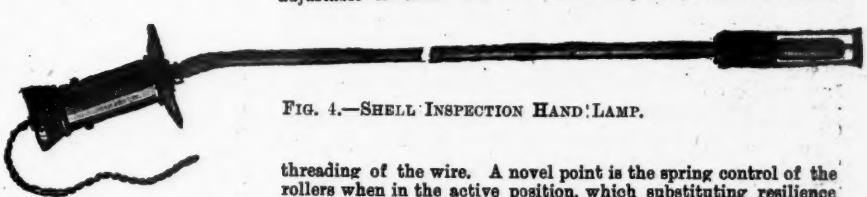


Fig. 4.—Shell Inspection Hand Lamp.

Any required number of wires can be coated simultaneously, the wire simply being wound on a drum and thus passed through the melting pot. The furnace is throughout most strongly constructed with an ample reserve of metal, to meet any possible contingency that may arise, and the workmanship is claimed to be such as is rarely found in furnace work.

Dead-Ending a Crane Trolley Wire.

The accompanying illustration shows a convenient and serviceable way of dead-ending a travelling-crane trolley wire. For a No. 00 copper wire a 0·75-in. punched wrought-iron bolt washer may be used, and for other sizes reference to a wire table will show the size of washer required to fit over twice the diameter of the wire. The fibre tube shown is used as a safety stop. It should be long enough so that the crane trolley will be lifted off the wire at a sufficient distance from the end of the crane travel to prevent an accident in case of emergency.—*Electrical World.*

Fig. 5.—Plain Washer used to Grip Trolley Wire.

BUSINESS NOTES.

Lamp Shades.—We illustrate herewith one of the "Mazda" lamp shades which are used in connection with the restricted lighting arrangements in the trains running on the Great Western and Metropolitan Joint Railway, between Hammersmith and New Cross. The shades used are of rectangular construction, one side being opaque and the other three framing transparencies of the design produced herewith. We understand

that the end in view is attained very successfully, a well diffused illumination being secured of as high intensity as permitted by the new regulations. These shades are available for use in contractors' and dealers' show-windows, &c. They pack flat for stock or postal purposes, and can be assembled in a moment and are carried by the shade ring of any standard lamp. All applications should be addressed to the British Thomson-Houston Co., Ltd., Publicity Department, 77, Upper Thames Street, E.C.

Board of Trade Inquiries.—Russia.—The Acting British Consul-General at Moscow (Mr. R. H. B. Lockhart) reports that a British engineer in that city, who claims to be well acquainted with trade and markets in Russia and to be able to conduct correspondence in Russian, is desirous of representing United Kingdom manufacturers of electric lifts, steam and water valves, fittings of all sorts, and dynamos. The name, &c., of the inquirer can be ascertained on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

The Commercial Intelligence Branch of the B. of T. has received inquiries from British firms at home for makers of the following :—

Celluloid acumulator boxes.
Electric bell pushes in wood.
Glass accumulator cells.

Catalogues and Lists.—The Cambridge Scientific Instrument Co., Ltd., Cambridge.—Illustrated list No. 195 containing a full description of their electrical distance thermometers (resistance type) for temperatures up to 1,000° F.

The Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—12-page pamphlet (No. 246) containing illustrated descriptive particulars and prices of military telephones, including buzzer call field telephones; combined buzzer and magneto call telephones; portable field telephone exchanges; also field telephone cable and portable drums for same. Wiring diagrams are given.

Messrs. Drake & Gorham, Ltd., 1, Felix Street, Westminster Bridge Road, London, S.E.—Pamphlet No. 238 (10 pages) contains illustrations and prices of El Grilstovo, Ovenette, El Cooko, and other Hot-point electric cooking appliances, also domestic irons, El Bako ovens, electric ranges and fires, &c.

Book Notices.—We have received from the Great Central Railway a copy of the second edition of its brochure, "The Magnet of Commerce," in which is brought together a vast amount of information, excellently illustrated by half-tone pictures, line diagrams, and maps, concerning the developments which are constantly taking place in the coalfields and industrial centres of Lancashire, Yorkshire, Nottinghamshire, Derbyshire, &c. It contains the latest statistical particulars available respecting coal output, coal exports, coke production, coke-ovens in use, Immingham dock traffic and charges, and so forth. Its contents justify it in claiming for it a place in any collection of industrial and commercial literature.

"Diesel Engines for Land and Marine Work." By A. P. Chalkley. London: Constable & Co. Price 8s. 6d. net.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXXII. Part I. Newcastle: The Institution.

"Les Cables Sous-Marins Allemands." By C. Lesage. Paris: Plon-Nourrit et Cie. Price 3 fr. 50.

"Relativity and the Electron Theory." By E. Cunningham. London: Longmans, Green & Co. Price 4s. net.

"The Telephone and Telephone Exchanges." By J. E. Kingsbury. London: Longmans, Green & Co. Price 12s. 6d. net.

Liquidation.—Teleradio Electric Co., Ltd.—This company is winding up voluntarily, with Mr. E. H. R. Trenow, Balfour House, Finsbury Pavement, E.C., as liquidator. A meeting of creditors is called for November 27th. Creditors must send particulars of debts, &c., to the liquidator by December 11th.

For Sale.—Particulars appear in our advertisement pages to-day of a sale of stock-in-trade and plant of a builder, decorator and electrician, which is to take place at Kensington on December 9th.

The Borough Council of Leigh, Lancs., has for disposal one 250-kw. direct-coupled steam dynamo; Messrs. John Fleming & Co., Ltd., of Albert Sawmills, Aberdeen, have for sale one engine and dynamo, four dynamos, one switchboard and 12 arc lamps. Particulars are given in our advertisement pages to-day.

Silvertown Carbons.—The India-rubber, Gutta-Percha and Telegraph Works Co., Ltd., of Silvertown, E., are carrying large stocks of carbon pencils for pocket light batteries. They are making a speciality of this line. In discussing carbon manufacture in these pages some months ago, we showed that the Silvertown Co. were among the pioneers in carbon manufacture in this country; indeed, we believe that they have been manufacturing carbons for nearly 50 years. Carbon can be supplied by them in almost any shape or size, and the articles made include plates for batteries, electric furnaces, &c.; rods for batteries; rings, tubes, blocks, disks, buttons, &c.; contacts for electrical apparatus, and carbons for lightning protectors, telephones and other instruments.

LIGHTING AND POWER NOTES.

Argentina.—The provincial Government of La Plata has decided to erect an electric station for the supply of electric light to the public offices, for which a sum of 90,000 pesos is now disbursed yearly. The scheme includes the supply of light to private consumers situated along the route through which the underground supply mains will run. It is proposed to install oil engines at the new waterworks in Soavedra Park, and to modify the existing equipment there, whereby such economies will be effected that the cost of electric current will work out at 3 centavos the kw.-hour, thus facilitating the eventual supply to private consumers at 50 per cent. reduction on the existing tariff; and allowing of the amortisation of the new plant within four years. The preparation of plans and final estimates is being undertaken.

A co-operative electric supply association has been formed in the City of Concordia. The plant, comprises two 200-h.p. Diesel engines and generators and a third of 150 h.p. At Lujan, it has been decided to amalgamate the two competing undertakings, the Sociedad Anonima Alambrado Elettrica taking over its rival's plant and shareholders.

According to the *Review of the River Plate*, the Hydro-Electric Co., of Tucuman, has been condemned to pay $38,000 m/n to the Compania Santa Ana Hileret Limitada, as the value of land occupied by the power house in the Quebrada de Lules. The same paper states that the basis of an arrangement has been arrived at between the Compania Alemana Transatlantica and the City of Buenos Ayres, in respect of the action brought by the former against the city to recover $858,103 m/n due for electric current supplied for lighting purposes.

Aylesbury.—Street Lighting.—The U.D.C. has decided that the charge for current for street lighting shall be the capital charges of the undertaking so far as they can be apportioned to street lighting, plus the actual cost of production at the works, this arrangement to stand until March 31st next, when the matter will be re-considered; the sum arrived at as the capital charge is £346.

Barnsley.—R.D.C. Lighting Scheme.—The question of the proposed lighting of the R.D.C.'s district by electricity has been deferred by the Electrical Distribution of Yorkshire, Ltd., owing to the Board of Trade's refusal to deal with any new Bills on account of the war.

Bo'ness.—Plant Extension.—The Secretary for Scotland has intimated that he has no objection to the proposed extension scheme, which would be carried out by the National Electrical Construction Co. at a suggested cost of from £6,000 to £7,000, under the usual conditions. The company is to be asked to submit plans and specifications to the Council's consulting engineer before a final decision is arrived at.—*Glasgow Herald.*

Brierfield.—Loan Application.—The D.C. has authorised the clerk to communicate with the Treasury, if necessary, for sanction to the borrowing of money on electricity capital account for new connections and services.

Bury.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £980 for mains required to be laid to the car depôt and Messrs. Webb's works.

Buckhurst Hill.—E.L. SCHEME DEFERRED.—The County of London Electric Supply Co. has informed the U.D.C. that in view of the decision of the B. of T. not to grant prov. orders during the period of the war, it has decided not to proceed with the scheme for the district.—*Essex County Chronicle.*

Buxton.—LOAN SANCTION.—The U.D.C. has received sanction to proposed loans of £445 (repayable in 15 years), and £159 (repayable in five years), for overspent balances of capital expenditure at the electricity works.

Cheadle and Gatley.—E.L. SCHEME.—After having received from Stockport and Manchester T.C.'s terms for the provision of a supply of electricity for the district, the U.D.C. has adjourned the matter pending the report of the surveyor upon an E.L. scheme for the township.

Coniston.—E.L. SCHEME.—With regard to the E.L. scheme for this parish, the Ulverston R.D.C. has referred the matter to the P.C. for consultation, and has decided that the work shall not be proceeded with until the sites for the poles for the overhead wires have been definitely approved of by the Council.

Continental.—GERMANY.—The first of four unusually large transformers intended for the new central electricity station at Golpa, has recently been completed. It has a capacity of 22,000 KW., and weighs 73 tons, the dimensions being: height, 19¾ ft., by 18½ ft. by 5½ ft.

Dublin.—The Corporation has sent back to the Electricity Committee a report in relation to tenders for the installation of an Underfeed stoker at the Pigeon House electricity station. Mr. Ryan remarked that an expert was to report on the whole electricity undertaking, and that they should be in a position to know whether expenditure of this kind was necessary. Consideration of a report on electrical energy supplied to theatres was postponed. A deputation from the city picture houses stated that they would be compelled to install their own plant if an increased rate were insisted upon.

Edinburgh.—NEW POWER STATION.—Last week the Council considered estimates amounting to £24,515 for shafts and tunnels for obtaining sea water for the condensing plant of the Portobello power station; the contractors' time for the completion of the contract was 65 weeks, and they had notified the Council that unless the tender was accepted at once they could not abide by the prices quoted, as the prices of materials were rising daily. Sir Alexander Kennedy also considered that the contract should be put in hand at once if the Council wished the station to be opened in 1917, as otherwise the buildings and plant would be ready before the sea-work tender was completed. The Council accepted the tender by 25 votes to 5.

Greenock.—The total units generated by the Corporation electricity works in the month of October amounted to 2,288,261, as compared with 1,336,728 in the corresponding month of last year.—*Glasgow Herald.*

Hull.—PRICE INCREASE.—The Electricity Committee has decided to increase the charges for electric light on the flat rate by a halfpenny per unit, and for other purposes by 15 per cent. upon existing charges, excepting where supplies are furnished under agreements for unexpired periods. The increases will come into force on January 1st, 1916.

Ilford.—DESTRUCTOR PLANT.—The L.G.B. having declined to receive a deputation with reference to the refusal of a loan of £870 for the erection of an electrical engine room at the dust destructor, referred to in a recent issue of the ELECTRICAL REVIEW, the U.D.C. has requested the Electricity Committee to bring up up the question of the equipment of the building at the earliest possible moment, the idea being to defray the cost out of the electricity reserve fund. The destructor is almost completed, and it is considered that practically one year's revenue from it would pay for the sum asked for.

India.—The electric drives at the mills under the agency of Messrs. Bradbury & Co., of Bombay, are proving remunerative, especially at the New Great Eastern Mills. The other mills under Messrs. Bradbury's agency, viz., the New City and the Colaba Land also show marked improvement in quality and quantity of production.

A portion of the electric machinery required to convert the driving of the Sun Mills in Bombay, by power from the Tata Hydro-electric Power Supply Co., Ltd., has arrived, and it is expected that the electrical installation will be completed and working early next year.—*Indian Textile Journal.*

Kilrea (Co. Derry).—The County Council, on a report of the surveyor, has granted permission to Mr. Peden, Kilrea, to erect poles for the purpose of supplying electric light in that town.

Leigh.—ELECTRIC PUMPING.—A scheme for providing electric power for the pumping of sewage, which has been submitted to the R.D.C. by the Pilkington Colliery Co., is under consideration.

Littleborough.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £1,093 and £907 in connection with the electricity undertaking.

Llanfair Caereinion.—ANNUAL REPORT.—The first annual report presented to the guarantors under the E.L. scheme shows that during the eight months current has been in use, a profit of £122 has been made. The cost of the undertaking was £1,072, and the profit reduces the liabilities of the guarantors to £950.

London.—KENSINGTON RATING APPEAL.—At the London Quarter Sessions, the Brompton and Kensington Electricity Supply Co. appealed against the increase of £1,000 in the assessment of the rateable value of the company's property by the Kensington Assessment Committee. The Court decided to reduce the rateable value by £400, leaving a net increase of £600 upon the quinquennial assessment settled in 1910. The chairman stated that the Court was of opinion that an increase of value had taken place which justified the inclusion of the property in provisional and supplemental lists at an enhanced rateable value, but not to the extent claimed by the Assessment Committee.

POPLAR.—LOAN SANCTION.—The L.C.C. has sanctioned a loan of £3,688 required for mains, subject to the B.C. agreeing to limit expenditure out of the loan during the war, and to provide out of funds under its control the amount authorised. It is proposed to advance the money out of the superannuation and pension funds, when a sufficient sum is available. The Committee has considered the question of consumers, who, taking supply under the contract system, have been compelled to restrict their lighting in accordance with police instructions. A reduction has already been made by the alteration of the fixed charge on capital expended by the Council for services, meters, and wiring installation, from 12½ per cent. to 8½ per cent. per annum, and the undertaking is one of the few that has not considered advancing charges owing to war conditions. The Committee does not recommend any reduction on the fixed KW. charge, which is at present £8 for inside lighting and £6 10s. for outside lighting. Every consumer has a right to change over from the contract system at the expiration of his agreement to the flat rate of 3d. per unit plus 8½ per cent. per annum on the capital expended by the Council for wiring premises, but any change of this sort must be for a period of not less than 12 months. Under the circumstances, the Committee does not consider it advisable that any rebate should be made in the KW. charge under contract for shop lighting. It suggests, however, that consumers should be allowed to purchase installations if they elect to change over to the flat rate system, at the original cost, less 5 per cent. per annum for depreciation.

ST. PANCRAS.—On July 14th the L.C.C. sanctioned the borrowing of £15,000 for a 5,000-KW. turbo-generator, subject to the acceleration of the repayment of the loans for plant and machinery for which 42 years had been granted. The Electricity Committee has considered the question, and decided that it would be purposeless to proceed further with any opposition to the terms of the L.C.C., only to such an extent as would be applicable during the course of the next three years, *i.e.*, the completion and putting in working order of the new turbo-generator. The Committee reports that it would cost about £3,000 per annum for the next 13 years to adopt the proposals in full of the L.C.C. in making the accelerated payments, and recommends that an offer of increased payments of £1,500 per annum for the next three years, commencing April 1st, 1916, be made on account of the 42 years' loans, and thereafter to make the accelerated payments in full as suggested by the County Council.

L.C.C.—The Finance Committee recommends the Council's sanction to the borrowing of £5,455 by the Islington B.C. for mains for electricity supply purposes.

Manchester.—BARTON SCHEME.—The letter of protest respecting the continuance of the work in connection with the erection of the new generation station at Barton, which was recently forwarded to the L.G.B. by the Ratepayers' Association (and referred to in this column a few weeks ago) has drawn from the L.G.B. a reply which was received in Manchester on Friday last. In this the Board states that it is satisfied that the T.C. has proper grounds for proceeding with the full scheme at this time, and it is not prepared to intervene further in the matter.

On the 17th inst. the city was enveloped in dense fog throughout the day, and the electricity consumption amounted to 709,400 units—a record. By comparison with the previous record this consumption was 10 per cent. higher, and the increased consumption compared with the corresponding dates of 1914 and 1913 was 20 per cent. and 27 per cent. respectively. In the neighbouring county borough of Salford, also, record figures were reached by the electricity department.

The consumption of current during the past six months is stated to be 30 per cent. higher than in the pre-war period, and an even larger demand than is now being met is expected.

Mayo.—The County Council has decided to install electric light in the Courthouse at Castlebar.

Newport (Mon.).—YEAR'S WORKING.—The annual report of the general manager, Mr. N. J. Young, and borough electrical engineer, Mr. A. Nichols Moore, on the year's working of the Corporation electricity department, shows a net profit of £744, as against a deficiency in the previous year of £1,240. The gross receipts were £44,615, and the gross profit £23,460 (slightly above the previous year's); interest, sinking fund and other charges—the latter being much less than in the previous year—amounted to

£22,716, as against £24,462. The department lost one of its largest consumers during the year, and thus despite the new business done, the units sold reached only 4,789,240, as against 4,929,683 in the previous year, the maximum demand also falling from 3,078 KW. to 2,909 KW. The generating costs show a very considerable decrease, amounting to £1,832, chiefly due to reduction in coal cost, which averaged 32d. per unit, as against 34d. in the previous year. The coal per unit generated fell from 5·05 lb. to 4·35 lb. An analysis of the output shows 1,107,315 units sold for lighting; 1,051,600 for power; 587,586 for public lighting; 1,178,500 for traction; 166,054 for heating; and 698,185 for bulk supply. The average price obtained per unit, calculated on the total revenue, was 2·24d., as against 2·17d. in the previous year.

Peterborough. — YEAR'S WORKING. — The annual accounts of the Corporation electricity undertaking for the year ended March 31st show expenditure amounting to £5,647, and receipts to £10,403. Loan charges amounted to £4,398; including the balance brought forward from last year, £346, and £696 revenue contribution to capital expenditure, the undertaking just paid its way. The number of units sold during the year was 973,752, against 920,488 in 1914.

Shanklin.—STREET LIGHTING.—The U.D.C. has decided to offer the Electric Light Co. £25 quarterly for street lighting during the continuance of the present conditions, plus the units consumed at the fire station. If these conditions are accepted, the Council will extend the contract after the war for a period equivalent to the entire close period now in operation on the contract terms existing before the war commenced.

Stalybridge.—At the annual meeting of the Stalybridge Joint Tramways and Electricity Board, last week, Mr. T. Perrin (chairman) spoke hopefully of the prospects of the Board's future operations, and stated that the electricity department was getting back its full load again.

Torquay.—CABLE LOANS.—The L.G.B., in intimating to the T.C. that no further objection would be raised to the completion of the laying of a new E.L. main in the town, has requested the Council, before a consent order can be issued, to submit a statement showing the total amount which will actually be required to meet all liabilities and how it is made up, as at present it is not quite clear to the Board that the Council will require to raise the whole sum of £18,000 sanctioned last February.

Walthamstow. — The Lighting Committee of the U.D.C. has considered the report of the electrical engineer as to the advisability of installing a water-softening plant for dealing with the circulating water for condensing purposes, and has recommended that a plant of a capacity of 5,000 gallons per hour be installed, at an estimated cost of £450. The Finance Committee recommends that the cost be met out of the revenue.

Whitstable.—STREET LIGHTING.—At a special meeting of the U.D.C. on November 16th, a notice was received from the Electric Supply Co. to the effect that after seven days it intended to apply to the president of the Institution of Civil Engineers for an arbitrator to be appointed to decide the dispute that has arisen with the Council as to the public lighting agreement. The Council decided to forward the letter and a copy of the clause in the agreement which is in dispute to Mr. M'Cardie, who previously advised the Council that, under the present conditions of restricted lighting, the agreement was null and void. The Council's offer is to pay the company 10s. per lamp for the six months' period in question.

Wirral.—PROV. ORDER.—The R.D.C. has deferred for a month consideration of an application from Messrs. Melling and Moss, of Northwich, for the Council's consent to the granting of a provisional order to Messrs. Johnson & Phillips, to supply electricity in the parishes of Hooton, Eastham, Childer Thornton, Willaston, Great Sutton and Little Sutton. Meanwhile further information is to be obtained from other authorities.

Wolverhampton. — BREAKDOWN. — A considerable portion of the town suffered from a failure of the electric supply on Wednesday evening last week. The trouble was stated to be due to the breakdown of an overloaded feeder cable, the electricity department being very much pressed by the supply required for local works.

Worcester.—STREET LIGHTING.—The street lighting is to be reduced by one-half, except at certain specified points. The reduction in lighting previously effected resulted in a saving of £398 in the cost of coal at the city electricity station, and a further saving of £139 is anticipated.

TRAMWAY and RAILWAY NOTES.

Bexley.—FEMALE LABOUR.—The U.D.C. has decided to employ women conductors on the Council's cars during the period of the war, the rate of pay to be 5½d. per hour.

Bingley.—The Council has decided to apply to the B. of T. for an extension of the period for the completion of the tramway round the Ryshworth Hill corner at Crossflats, until 12 months after the end of the war.

Bournemouth.—The Tramways Committee has recommended that the tramway service be suspended at 10 p.m. instead of 11.30 p.m., on and after December next.

Bradford.—WAGES.—The local branch of the Amalgamated Association of Tramway and Vehicle Workers has applied to the Corporation on behalf of the employés, for an increase of 5s. per week for employés paid weekly and 1d. an hour additional for men paid by the hour, in place of the bonus granted. A special meeting of the Committee is to be held on Monday to consider the question, and also the manager's report on the shortage of labour and the effect of recruiting on the tramway service. The cost to the department of the proposals, if carried out, would be about £12,000 a year.

Burnley.—WAGES.—The tramway workers and enginemen have asked the Corporation for an advance of 3s. per week in their wages.

Croydon.—FEMALE LABOUR.—The B.C. has sanctioned the engagement of women as conductors, at the same rate of pay per hour as men. Their terms of duty, it was stated, would be 8 or 8½ hours, and all the available male conductors (where ineligible for military service) would be retained.

Glasgow. — WOMEN DRIVERS. — The local Trades Council has entered a protest against the T.C.'s appointment of women car-drivers, and from the official minute of the latter body it appears that so far no definite decision as to the employment of such women has been come to. It is believed, however, that the engagement of the women is of an experimental character, and that meantime they are undergoing a further course of training before the T.C. finally approves of their being put on the driving platform as qualified drivers.

Halifax.—RECRUITING AND WOMEN CONDUCTORS.—The recruitment of men from the Corporation tramway department is having a deleterious effect upon the working of the undertaking. More than half of the male conductors and drivers have joined various units in the Army and Navy, and some of those remaining are working 73 hours per week. On some of the routes the late cars are being taken off, and it appears to be evident that more women conductors will have to be secured to assist in maintaining an efficient service of cars.

Following upon the lead given by several other municipalities, women conductors have made their appearance on the Hebden Bridge route of the Halifax tramways, and are giving complete satisfaction.

Japan.—The annual report of the British Commercial Attaché in Tokio contains some particulars regarding the Tokio-Yokohama Government electric railway, to which reference has been made in these notes. The following may be of interest:—This railway, which runs side by side with the existing steam track, is 19 miles long; between the two termini there are 14 stations and trains will stop for 30 seconds at each. The power for driving the railway is derived from a gas-power station situated about midway between the two main stations, and containing four Lilleshall tandem double-acting gas engines direct coupled to 1,500-K.V.A. 11,000-volt three-phase 25-cycle alternators, three of these generators being in daily service and one spare. The gas is produced in three Mond gas producing ammonia recovery plants, two of these plants being in daily service and one spare. It is noteworthy that the whole of the steam required is raised in boilers using the waste heat from the gas-engine exhaust. From the power-house the high-tension current is distributed to four substations, and there converted to 1,200 volts direct-current for supply to the trolley wire. The car motors are designed for 600 volts and run two in series on the line voltage of 1,200. The overhead collector for the car is of the pantograph type.

Unfortunately, the electric railway had only been in operation for a few days at the end of the year when it became necessary for the authorities to discontinue the service. As far as it is possible to ascertain, the whole of the trouble lay with the overhead equipment, which at the time of opening to public service appears to have been in an unfinished state. Since the line has been shut down it has been found that the height of conductor from rail level varied considerably, especially under bridges, this proving very troublesome when the trains were in rapid motion, causing the pantograph collector to oscillate badly and thereby to stress the conductor unduly. It was also found that the conductor varied from the mid position between rails, with the result that the conductor had a great tendency to creep along the collector and in many cases actually to slip entirely off. The conductor hangers from the catenary wire gave trouble, owing to insufficient latitude or play being allowed in the loops encircling the catenary, and in many places the thrust of the pantograph distorted these badly, thus raising the height of the conductor in these places.

London.—All the L.C.C. tramwaymen of military age have been ordered to submit themselves for medical examination, and if unfit for military service to get a certificate to that effect. —*Daily Chronicle.*

The *Railway News*, in its current issue, states that in view of the completion of the electric power station at Wimbledon, the London and South-Western Railway has decided to shut down the generating station of the Waterloo and City line very shortly, the power supply therefor being obtained from the Wimbledon station.

Lowestoft.—Female Labour.—The general manager of the tramways undertaking has been authorised to employ female conductors if he finds it necessary to do so.

Preston.—The Tramways Committee has recommended the purchase of a pair of jacks for each of the tramcars, the estimated cost being £250.

S.W. Railway Electrification.—Two trial trips were run with six-coach electric trains on the Kingston loop, on November 19th; it is intended to supersede the steam service on the 28th inst. An accelerated service is to be given to Teddington, Kingston, Hampton Wick, &c., with a train to and from Waterloo every five minutes. On the Thames Valley line there will be half-hourly services, which will be diverted through Kingston to Waterloo, instead of through Richmond.

Stockport.—Female Labour.—More than a 100 motormen and conductors have enlisted since the outbreak of the war, and the staff has been so seriously depleted, that it has now been decided to engage women car conductors.

Newport.—Year's Working.—During the year ended March 31st last, the Corporation tramways department had a total revenue amounting to £42,704, while the gross profit was £11,748, as compared with £6,697 in 1913-14, and after meeting the usual financial charges the year's working resulted in a surplus of £2,417, as compared with a deficit of £2,616 in 1913-14. The revenue was somewhat higher, more passengers being carried despite a decrease in car-milage. The passengers numbered 9,410,109, the receipts averaging 10·6d. per car-mile. The compensation and renewals funds now amount to £3,480.

Middlesex.—The Metropolitan Electric Tramways, Ltd., is applying for an Act for extending the time for completion of certain tramways, trolley vehicle equipment, &c., authorised under the previous Acts.

West Ham.—Female Labour.—The Corporation has been recommended to authorise the engagement of women as tramcar conductors, at the same rates of wages per hour as now paid to male conductors. The Tramways Committee proposes to purchase additional plant, at an estimated cost of £800.

TELEGRAPH and TELEPHONE NOTES.

Code Telegrams.—The arrest of Victor Sly, on a charge of carrying on unauthorised negotiations for dealing in war material has brought to light a secret code in "open language," code words being provided for all kinds of things connected with munitions of war. As we have pointed out, there is no difficulty in devising such codes, and the use of "open language" is an utterly ineffective safeguard against communication with the enemy by cable.

Secret Wireless.—The British Ambassador in the United States has drawn the attention of the Government to a private German wireless station which is said to be secretly operated in a suburb of Portland, Maine, and American Navy inspectors have been ordered to investigate the matter.

Singapore.—A wireless station has just been erected at Singapore for public service.

Wireless Telephony.—It is reported that two Swedish Army officers have invented a simple apparatus by means of which wireless telephonic messages may be dispatched from trains or automobiles travelling at high speed.

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—November 30th. Pea coal for mechanical stokers for the U.D.C. Electricity Works. Electrical Engineer, Laburnum Road.

Athy.—December 6th. U.D.C. Tenders are invited for lighting the town with electricity. Particulars from Mr. J. A. Lawler, Town Clerk.

Australia.—December 20th. P.M.G.'s Department, N.S.W. 4,250 telephones (Schedule 454).*

Adelaide.—January 19th. P.M.G. Common-battery switchboard. See "Official Notices" November 19th.*

January 26th. Deputy P.M.G. Twenty tons of galvanised-iron wire, 400 lb. to the mile.*

Brisbane.—P.M.G. January 26th.—Galvanised-iron wire. December 1st.—Measuring instruments. January 5th.—Jointing sleeves and copper-clad steel wire. See "Official Notices" November 19th.

January 26th. Deputy P.M.G. Telephone instruments, parts and accessories.*

Sydney.—December 20th. Metropolitan Board of Water Supply and Sewerage. Three centrifugal pumps and electric motors, with switchboards, starters, &c., for the pumping station at Marrickville, N.S.W. Deposit £10. Tenders to the Board, at 341, Pitt Street, Sydney, N.S.W.*

January 31st, 1916. Three electrically-operated railway freight-car transferers, for Jones Bay wharfage, Pyrmont. Particulars from Engineer-in-Chief of the Harbour Trust, Circular Quay.

Melbourne.—December 14th. Deputy P.M.G. Eleven sections of a lamp-signalling trunk-line switchboard, and other material necessary for increasing the equipment of Melbourne Trunk Exchange from 108 to 240 lines. Schedule 1,207.*

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

Dundee.—November 29th. Town Council. 600 tons steel tramway rails, 15 tons steel tie bars. Forms of tender from Mr. Jas. Thomson, City Engineer, Municipal Offices.

Enniskillen.—December 1st. Sligo, Leitrim and Northern Counties Railway Co. Twelve months' supply of telegraph materials. Mr. J. Duff, Secretary's office.

London.—December 9th. H.M. Commissioners of Works. Twelve months' supply of electric cable and wire. Forms of tender from the Controller of Supplies, H.M. Office of Works, 18, Queen Anne's Gate, Westminster, S.W.

Natal.—December 1st. The Corporation of Durban. Tenders for underground cables and cast-iron pipes for telephone cables. Particulars from Messrs. Webster, Steel & Co., 5, East India Avenue, E.C.

Spain.—November 30th. The municipal authorities of Villanueve de Castellon (Province of Valencia) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

CLOSED.

Bedford.—Messrs. W. S. Wilton & Co. have secured the contract for the electric light installation in the steam and electric pumping stations for the Corporation.

Edinburgh.—The City Council has accepted the tender of Messrs. C. Brand & Son for shafts and tunnels in connection with the condensing plant for Portobello power station, at £24,515.

Glasgow.—The T.C.'s Committee on Works and Stores has recommended the acceptance of the offer of Messrs. Pirelli, Ltd., to supply rubber-insulated cables.

Government Contracts.—List of new contracts, October, 1915:—

War Office.

Insulator brackets.—Bullers, Ltd.; Douglas Bros., Ltd.; Vulcan Co.
Electric cable and wire.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Craigpark Electric Cable Co., Ltd.; I. Frankenburg & Sons, Ltd.; W. T. Glover & Co., Ltd.; A. Green, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; C. Macintosh and Co.; Western Electric Co., Ltd.
Commutators (telegraph).—Automatic Telephone Manufacturing Co., Ltd.; S. G. Brown; H. White & Co.
Dynamos.—Austin Motor Co., Ltd.; Fyfe, Wilson & Co.
Insulators.—Litholite, Ltd.; T. De la Rue & Co., Ltd.
Lamps (electric).—British Thomson-Houston Co., Ltd.; General Electric Co., Ltd.
Switches.—Berry & Hayward; General Electric Co., Ltd.; Laing, Wharton, Ltd.; Veritys, Ltd.
Works services.—Accumulators, Park Hall Camp, Oswestry: Chloride Electrical Storage Co., Ltd. Electric lighting, Wimbledon Common: Borough Electrical Engineer, Wimbledon. Infantry Barracks, Redford: Lowdon Bros. & Co.

India Office Store Department.

Apparatus.—Elliott Bros.
Coils, &c.—Marconi's Wireless Telegraph Co., Ltd.
Condensers.—Peel-Conner Telephone Works, Ltd.
Insulators.—Taylor, Tunnicliffe & Co.
Wire.—R. Johnson & Nephew, Ltd.

H.M. Office of Works.

Engineering works.—Ministry of Munitions Electric Passenger Lift.—Medway's Safety Lift Co.

General Post Office.

Apparatus (protective).—Siemens Bros. & Co., Ltd.
" (telephone).—Automatic Telephone Manufacturing Co., Ltd. British L. M. Ericsson Manufacturing Co., Ltd.; Siemens Bros. & Co. Ltd.
Cable (submarine).—Telegraph Construction and Maintenance Co., Ltd.
" (telephonic).—W. T. Henley's Telegraph Works Co., Ltd.; Johnson and Phillips, Ltd; Telegraph Construction and Maintenance Co. Ltd.; Union Cable Co., Ltd; Western Electric Co., Ltd.
Cords (telephone).—British Insulated and Helsby Cables, Ltd.
Lamps (telephones).—General Electric Co., Ltd.
Wire (bronze).—T. Bolton & Sons, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smith's, Ltd.).
Electric lighting, Superintendent Engineer's Office, Denman Street, S.E.—A. Hawkins & Sons.
Laying pipes, ducts, and "U" troughing, Deptford.—Foote & Milne, Ltd.
Replacing battery, Avenue Telephone Exchange.—Tudor Accumulator Co Ltd.
Telephone Exchange equipment, Manchester.—Peel-Conner Telephon Co., Ltd.
Telephone Exchange extension, Norwich.—Western Electric Co., Ltd.

London.—The tender of Messrs. Finch & Wheeler has been accepted by the London Insurance Committee, at £459, for carrying out lighting work at certain premises taken over for additional office accommodation. The contract includes £244 for electric fittings.

St. Pancras.—The B.C. has accepted the offer of the General Electric Co. for the balance of the carbons tendered for, at £1,022.

Walthamstow.—The Lighting Committee of the U.D.C. has accepted the tender of Messrs. Cleeves & Co. for the supply of 300 tons of West Hallam small nuts, at £1 2s. 10d. per ton.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, November 26th. At 7.30 p.m. At Bolbec Hall, Newcastle. General Meeting.

University College, London.—Fridays, November 26th and December 3rd. At 5 p.m. Fourth and fifth lectures on "Electric Heating and Electric Furnaces," by Prof. J. A. Fleming, F.R.S.

Manchester Association of Engineers.—Saturday, November 27th. At Grand Hotel, Aytoun Street. Paper on "Design and Application of Ball-bearings," by Mr. H. J. Moysey.

Royal Society of Arts.—Monday, November 29th. At 4.30 p.m. At John Street, Adelphi. Cantor Lecture, on "Optical Glass," by Dr. W. Rosenhain, F.R.S.

Institution of Civil Engineers.—Tuesday, November 30th. At 5.30 p.m. At Great George Street, S.W. Papers on "Harbour and Coast Defence Works at Alexandria," by Mr. D. E. Lloyd-Davies; and "Galvan Port, Bahia Blanca, Argentine," by Mr. C. A. Terry; and Special General Meeting.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, November 30th. At 7.30 p.m., at the Engineers' Club. Paper on "Some Difficulties of Design of High-Speed Generators," by Prof. A. B. Field.

Chemical Society.—Thursday, December 2nd. At 8 p.m. At Burlington House. Ordinary Scientific Meeting.

Salford Technical and Engineering Association.—Saturday, December 4th. Visit to the Salford Corporation Cleansing and Flag-Making Department, Langley Road Depôt, and Annual Meeting.

ELECTRICAL ACCIDENTS IN 1914.

The report of Mr. G. Scott Ram for 1914 shows that 65 electrical accidents took place in public electricity supply and traction power stations, of which three were fatal; 34 took place in other generating stations, with one fatality. Non-electrical accidents numbered 381, of which 10 proved fatal; this total is less than in the preceding year by 58, but the electrical accidents showed an increase of five. One of the mechanical accidents was due to the bursting of a steel bottle of compressed air for starting a gas engine, and resulted in two deaths. In factories other than electrical stations there were 350 electrical accidents, involving 16 deaths, a reduction of 68 on the aggregate.

All the fatalities due to electric shock (20 in number) occurred in connection with alternating current, in 15 cases at a pressure of 440 volts or less. In several instances artificial respiration was not tried, or was discontinued after a short period, on the statement of a doctor that the victim was dead, and Mr. Ram, pointing out that patients may often be revived after as long as two hours from the time of the accident, remarks that the medical profession appears to be somewhat ignorant on this matter.

As usual, an extraordinary amount of carelessness and ignorance on the part of men regarded as skilled, not only in the operation but also in the design and construction of electrical plant, is revealed by the report, which we shall reproduce in an early issue.

NOTES.

B.E.A.M.A. Annual Dinner.—The B.E.A.M.A. will not hold an annual dinner for the session 1915-16.

Properties of Tungsten.—At the annual meeting of the American Physical Society, on October 30th, reading a paper on "Radiation from Tungsten Filaments and the Mechanical Equivalent of Light," Dr. Irving Langmuir (of the research laboratory of the General Electric Co., Schenectady, N.Y.) stated that the resistivity, radiant energy (watts per sq. centimetre) and intrinsic brilliancy (candles per sq. centimetre) of tungsten filaments had been determined up to the melting point of tungsten, 3,560° K. (absolute). The resistivity increases accurately with the 1·24th power of the temperature; the corresponding exponent for the energy radiated is variable and decreases from 5·6 at 1,000° to 4·75 at 3,500° K. Under normal operating conditions (1 watt per candle in vacuum) tungsten radiates 32 per cent. as much energy as a black body at the same temperature. The light radiated from tungsten is bluer than that from a black body at the same temperature, and matches that from a black body at a temperature from 50° to 80° higher. By comparing the measurements of brilliancy with a result calculated from the Planck equation and visibility curve, the mechanical equivalent of light is found to be 0·00121 watt per lumen, or 0·0152 watt per mean spherical candle.

A second paper by Dr. Langmuir, on "Heat Conductivity of Tungsten at High Temperatures and the Wiedemann-Franz Relation," showed that by a development of the mathematical theory of the temperature distribution along a tungsten filament near a cooling junction, it has been possible to recalculate the heat conductivity of tungsten from the experimental data of Worthing. The new result is 1·14 watts per centimetre per degree at 2,200° K., and is practically independent of the temperature. The relation between the heat conductivity and the electrical conductivity is thus found to be in good agreement with that which has been obtained with other metals.—*Electrical World.*

Electrical Prosperity Week.—The elaborate preparations which are being made in the United States for "Electrical Prosperity Week" are practically completed, and the celebration will take place from the 29th inst. to December 4th. According to the *Electrical World*, "workmen in hundreds of cities throughout the nation are actively engaged upon the construction features, while committees and executives are giving the final touch to arrangements which will enable the event to measure up to expectations.

"Brooklyn, N.Y., is to have an electrical show. Another feature will be a far-reaching house-wiring campaign conducted by the Edison Electric Illuminating Co., of Brooklyn, in conjunction with the contractors, as announced in these columns last week. Electrical dealers will co-operate by window displays designed especially for the week, and the public interest in the celebration will be further intensified by illumination of prominent buildings and arches.

"In Philadelphia the electrical interests will conduct a wiring campaign, in which a discount of $1 per outlet will be allowed on the wiring of all ready-built dwellings and stores. The Philadelphia Electric Co. will hold special appliance exhibits and demonstrations, including window displays and exterior decorations. Advertising giving publicity to Electrical Prosperity Week, and to electricity in general, will be conducted in the street cars. The newspaper advertising of the electrical interests will also be greatly increased. Plans are also under way in Philadelphia to construct four allegorical, electrically-lighted floats to parade in various sections of the city on different nights during the week. One float will be devoted to general lamp illumination; another will depict allegorically electric power; a third will be devoted to a general figurative display of illumination, while the fourth float, with the assistance of a trailer, will give motion-picture demonstrations of domestic applications of electricity. . . .

"It is announced by the Denver Gas and Electric Light Co. that a grand celebration will be held in Denver, the climax being a prosperity show to be held on the last four days of the week under the auspices of the Colorado Electric Club. An electric-automobile parade is also contemplated. Various spectacular features are being prepared which are likely to draw crowds to the electrical show and its vicinity. Some of the features planned are the showing by wireless, on a miniature scale, of the manœuvres of a battleship, a facsimile of a submarine, an aerial or Zeppelin battle, and various high-frequency electrical-discharge features of a nature to interest the public. . . .

"Thus far definite plans have been formulated for holding electrical shows in more than 22 leading cities of the United States. Many others have this feature under serious consideration. Many mayors of cities, together with many civic organisations, have endorsed the plan, and are actively engaged in carrying out various measures for its support.

"Electrical interests are enthusiastic over the celebration, and the event is expected to surpass all trade movements conducted heretofore, and to prove highly creditable to the electrical industry."

And all this is only the climax of an unprecedented advertising campaign.

Rifle Club Friendly.—A friendly post match took place between teams representing the British Thomson-Houston and the British Electric Transformer Companies' Rifle Clubs, on Saturday last. The teams consisted of eight members, the best six cards only to count. The result was that the B.T.H. Club scored 562, while the British Electric Transformer Club totalled 566, on the best six targets, that is an average of 93·6 and 94·3 respectively. The British Electric Transformer Club, whose address is Hayes, Middlesex, is anxious to arrange some friendly matches, and will be glad to hear from any miniature rifle club in the trade which has any dates vacant either for shoulder to shoulder or post matches.

Assault on a Woman Tramcar Conductor.—At Salford, on Saturday, a collier named Wm. Glass was charged with drunkenness and with assaulting a woman car conductor employed by the Salford Tramways Committee. After tendering an insufficient amount for his fare, he caught hold of the conductor by the throat. She fell into the road and was rendered unconscious, and her uniform was damaged to the extent of £3. The Stipendiary sentenced Glass to two months' imprisonment.

Electric Shipping Cranes.—There are steam shipping cranes still to be seen at wharves on many of our important rivers. It will be of interest to record some details of the operation and maintenance of electric shipping cranes. Two 5-ton cranes come under review in these notes. No. 1 crane was put to work in August, 1902, and No. 2 crane in June, 1905. Both cranes were constructed by Messrs. Cowan, Sheldon & Co., and, except in the height of the structures, are identical one with the other. The hoisting motors are 35 B.H.P. at 260 R.P.M., and the travelling motors are of 6 B.H.P. at 1,250 R.P.M. They operate on a 240-volt D.C. supply. The operations of both cranes working on the loading of pig-iron from bogies on a wharf to the hold of a ship will be considered. Each sling of metal weighed about two tons. The time occupied from the sling leaving a bogie, depositing the metal in the ship and the empty chain arriving back at the bogie averaged 90 seconds. This would give 40 slings per hour per crane, or 80 tons of metal shipped per hour per crane. This quantity does not, of course, work out in actual practice, as it would mean constant operation of cranes, whereas small delays are inevitable, such as barring bogies into position, &c., but with good cranemen, slingers and stowers, an average shipment of 50 tons of metal per hour per crane can be maintained. Power is only used for hoisting and slewing for a few seconds with each shipment of a sling, momentum in the case of slewing carrying the crane a considerable portion of its travel. The lowering of the metal is controlled by hand brake, no power being used from the supply mains.

The total number of Board of Trade units used in shipping 700 tons of pig-iron was 52, and at, say, 2d. per unit, the total cost for power was 8s. 8d. In the particular case dealt with power is supplied at ½d. per unit.

No. 1 crane, put to work in 1902, had new bushes fixed in the hoisting motor, and the armature re-wound in 1914. No other repairs except of a trifling nature have been necessary. No. 2 crane, erected in 1905, has required no repairs to motors up to the present time, and the mechanical repairs have been such as are not worth mentioning. Apart from the shipping of pig-iron, these cranes have unloaded tens of thousands of tons of iron ore. In the case of general cargo, a crane is often 15 to 20 minutes in dealing with one piece goods of heavy weight and large dimensions, and during the majority of this time no power is being used. The steam crane, which commences to burn coal two hours before it does any work and burns it continuously through periods of idleness, compares very unfavourably in every way with the electric crane, which consumes power only when useful work is being done and works at a high efficiency.

Compressed-Air Explosions.—In the annual report of the Chief Inspector of Factories and Workshops for 1914, several instances of explosions of cylinders containing compressed gases are briefly described. An explosion in Kent partially wrecked a Diesel engine; cylinders containing compressed air were being used to start the engine, and one of them was found to have held oxygen. On the ss. *Mauretania* a cylinder which had contained oxygen, and had originally been painted black, was in use to feed a blow-pipe, when it exploded, killing four men; it was found that the cylinder had been painted red by a previous customer of the gas company, and thus got amongst the coal-gas cylinders, and was charged with coal-gas, which formed an explosive mixture with the residual oxygen. Although this cylinder had a right-hand screwed connection, to distinguish it from the coal-gas cylinders which have left hand threads, the person who charged it succeeded in making the connection with the compressing machine, and the workman who used it made an adapter in order to use it on the wrong connection with the blow-pipe. An air receiver, used for starting three large gas engines in Staffordshire, exploded, and killed two men; the accident was ascribed to lubricating oil. A similar explosion took place in Leeds.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week, at the first meeting of the Session, which was very well attended, Sir John Snell invited the members to pass a vote of condolence with the family of the late Hon. Treasurer, Mr. Robert Hammond, by rising to their feet. He then announced that the Council had elected Mr. J. E. Kingsbury to fill the vacant office, and the choice was endorsed by general applause; he also announced that M. Maurice Leblanc had been elected an honorary member of the Institution. Mr. J. D. Blaikley, the husband of the last surviving niece of Michael Faraday, presented a valuable collection of Faraday's papers to the Institution, and in doing so described his personal recollections of Faraday and of his family. Prof. S. P. Thompson, who, as the author of a life of Faraday, was well acquainted with the collection, expressed the gratitude of the members to Mr. Blaikley, and was supported by Mr. W. M. Mordey, who also was familiar with the papers, and the members signified their approval in the usual manner. Mr. Mordey also presented two interesting relics of Faraday to the Institution, one being a note-book and the other a piece of heavy glass made by Faraday and believed to be the identical piece with which the scientist discovered the principle of magneto-optic rotation and the diamagnetism of glass, for which the donor was cordially thanked. The retiring president then presented the premiums to the winners, and installed Mr. C. P. Sparks in the chair.

Mr. W. Duddell moved a hearty vote of thanks to Sir John Snell, which was seconded by Mr. J. S. Highfield and enthusiastically accorded, and the new president then delivered his inaugural address, which is abstracted elsewhere in this issue. A vote of thanks to the president was moved by Mr. C. H. Wordingham, seconded by Dr. Alex. Russell and unanimously adopted by the meeting.

Before dealing with the main subject of his address ("Electricity Supply"), Mr. Sparks reminded the members of the importance of every individual member working in the best way he could for the good of King and country, and mentioned that 1,150 members were on active service. He also impressed upon the younger members of the electrical profession the importance of joining the Institution, and expressed the view that the commercial engineer was just as much a recognised member of the profession as a pure scientist. In this connection he entered a protest against the prevailing practice of accepting the lowest tender, pointing out that if a reasonable margin of profit was not secured the contractor could not do his duty by the purchasers, and provision could not be made for development and improvement. "The national interest would be better served by encouraging private enterprise to develop invention, by allowing manufacturers a reasonable margin of profit, than by securing—for the moment only—slight fractional reductions in the costs of public service undertakings through acceptance of the lowest tender, which was not always necessarily the most favourable."

Electric Engine Starters.—Dealing with the recent lamentable accident at Beachy Head, and the need for safeguards against similar fatalities, *The Motor* says that the electric starter lends itself particularly well to the safety principle; the closing of the starter operating circuit can be made absolutely dependent on the movement of the gear lever to neutral position. This simply means that instead of having one break in the circuit, as represented by the starter pedal, or, in the case of some cars, a starter switch on the dash, there are two breaks, and one of these must be closed by a "safety" movement of the gear lever. It might be contended that an ignition switch—preferably a plug or key switch—should be sufficient safeguard if the driver had to leave his car, and were he remiss enough to leave it in gear; but, even in this condition, there still lies a hidden danger, because most electric starters are very powerful, sufficiently so, in fact, to move the car when in first, or even second gear, and against the resistance of a non-firing engine. Thus, it is clear that on a slightly falling gradient a car could easily get away with the starter driving through the first or second gear. So powerful are these starters that, as an experiment, a large car has been driven a distance of a mile on low gear before the battery became exhausted. Obviously, it depends on the size of the battery as to how far it will run the car, and users of starters are, as a rule, warned against trying the experiment, as it damages the battery. The problem, on the whole, is a simpler one to solve than rendering a car safe from starting in gear from the ordinary starting handle, because, as stated, the electrical circuit contains inherently in itself the basis of safety, and it only requires proper application to ensure success.

The Fixation of Nitrogen.—A further step in connection with the scheme projected for the fixation of nitrogen in the district of the lignite mines of Bitterfeld has been taken by the registration of the Electro-Salpeter Works Co., with headquarters at Zschornewitz Bitterfeld. The share capital is £150,000, and the names of the promoters are mostly persons associated with the A.E.G. and the Berlin Electricity Works Co. It will be remembered that these two companies some months ago formed the Electro-Works Co., of Golpa-Jessenitz, to acquire possession of the lignite mines in question for the purpose of using the fuel for the production of electrical energy, which is to be furnished, among others, to undertakings for the fixation of atmospheric nitrogen, of which the Electro-Salpeter Co. appears to be the initial concern.

Electrochemistry as a Day Load.—In Switzerland the difficulties encountered in securing a large load throughout the year are reported to be much greater than in other countries, as the demand is only heavy during a portion of the year (in the season), and is insignificant during the remainder of the year. The idea has consequently arisen to dispose of the energy at lower prices during the period of slack demand, and thus obtain a better load factor. As the price under individual enterprise in this direction would still be relatively dear, it is intended to overcome this obstacle by means of united efforts. The question was recently considered at a meeting held at Zurich of representatives of 12 Northern and Eastern Swiss electricity works, who suggested that the available energy should be combined in the period of low demand, and be utilised in a joint undertaking for the production of nitrogen from the atmosphere, or for the manufacture of ferro-silicon and chrome iron. The necessary mains leading to the suggested electrochemical works would also be used in case of necessity, such as a breakdown, overload, &c., for rendering mutual aid to the associated works. A committee has been appointed to ascertain the power available, and to approach an electrochemical works on the matter, and in the event of an initial experiment being successful, it is proposed to endeavour to introduce a similar scheme in the other parts of Switzerland.

Organising British Engineering Industry.—The Engineers' Club, Manchester, held a meeting last Friday, to consider the report of its Special Committee which, after sitting for some months past, has prepared a number of recommendations. The Committee, after elaborating very ambitious proposals in some detail, says that it considers the multiplication of organisations undesirable. Yet it is convinced that "advantage can best be taken of the present opportunity by the formation of an association on a non-trading and non-interference-with-prices basis." We shall refer to the matter in a later issue.

Inquiries.—Makers of electric hair dryers and of the "Darling" electric radiator are asked for.

Appointments Vacant.—Telephone inspector, for the City of Birmingham electric supply department; temporary clerks (50s. and 30s.), for the Borough of Swindon electricity and tramway department; electrical engineer for Maxborough U.D.C. (£200). Particulars are given in our advertisement pages to-day.

Patent Application.—Application has been made to the Board of Trade for the avoidance or suspension of Patent No. 605/09 granted to Messrs. Siemens Bros. & Co., Ltd, for the electrolysis of aqueous saline solutions, by the Refractory Zinc Ore Treatment Co.

German Interests in British Companies.—In the House of Commons on Tuesday, a discussion took place on the above question, a member calling attention to the decision of the Court of Appeal in the case of the Continental Tyre and Rubber Co. (Great Britain), Ltd., *v.* the Daimler Co., and asking that the Attorney-General should advise the Government to carry the case to the Lords at once, or to promote legislation to bring the law of the country more in accordance with public policy. The Attorney-General, in the course of his reply to the discussion, said, according to the report in the *Times* for Wednesday, that the legal point at issue was extremely disputable. To get a decision in the House of Lords would take weeks, in the most favourable circumstances, and might take months. "When hon. members asked why, after the war, should money made by these companies be paid to the enemy, the answer he would give was that we were not dealing here with one separate subject-matter, and that the whole topic of the treatment of alien enemy property which was within the jurisdiction of this country was a very complicated one. It applied to all the German assets in the country, and under the custom of nations which had been observed in many wars it had not been the practice to confiscate—unless under exceptional circumstances—the property of the enemy. The question had not been neglected for a moment. An inspector had been appointed under the Trading with the Enemy Act, 1914, in the case of every company in which the majority of shares was held by enemies or in which the majority of the directorate consisted of enemies. Inspectors had also been appointed, even where the majority of directors did not consist of enemy aliens, where there was any ground for suspicion. In every case where an inspector had thought it desirable to appoint a supervisor one had been appointed in order to keep watch over everything that took place. In most cases it had not been thought necessary. In the case of 492 companies inspectors had been appointed; in the case of 232 companies supervisors had been appointed; in the case of eight companies controllers had been appointed; and in the case of enemy firms or persons 185 inspectors and 86 supervisors had been appointed. When hon. members talked of legislation they should have in their minds a clear idea of the legislation they meant. He, personally, was not at all indisposed to consider any reasonable practical suggestion, but he only knew of one which would meet the case to any extent. That was that they should take a certain proportion, and say, if the alien holding passed beyond that, then the company should not be treated as being a British corporation. It might be possible to do something on these lines, but it should not be for often that by the transfer of four or five shares the company might always be made to pass the dividing line. It was when one tried to draft a Bill that one saw the practical difficulties, but he assured the House that the matter was under most careful consideration."

Electric Heating and Electric Furnaces.—In his third lecture on this subject at University College, London, Prof. Fleming dealt with various types of electric furnace, commencing with resistance furnaces. The Acheson furnaces for the production of carborundum and graphite were described, as well as the Kryptol furnace for heating crucibles, &c., by contact, and the Heraeus laboratory furnaces with platinum heating spirals. The use of carbon as the resistance material for large operations, and of a bath of molten salts for tempering tools, &c., was also described; in the latter case the latent heat of the fused salt can be utilised to maintain the bath at a constant temperature, no rise in temperature being possible so long as any unfused salt is present.

Induction furnaces were next dealt with, beginning with the invention of the type by Dr. S. Z de Ferranti in 1887. Furnaces of this kind are made in large sizes, a Kjellin furnace for making steel from pig and scrap iron, with a power input of 736 KW., being referred to; the iron core of the transformer in this case weighed 35 tons. The Frick furnace is of similar design, and both these are mainly used in Sweden for making high-class steel. The Röhling-Rodenhauser furnace has a melting channel in the shape of the figure 8, the centre portion forming a convenient chamber in which a large quantity of steel can be held in a molten condition; auxiliary conduction heating of this central hearth is provided by iron electrodes built into the furnace walls and connected to heavy secondary coils on the transformer. A furnace capable of producing a ton of steel per heat consumes 90 amperes at 3,000 volts; the heat lasts four to six hours, and the energy consumption is about 930 KW.-hours per ton. The steel costs £7 per ton. In the Hjorth induction furnace the cores of the transformer are stationary, clearance holes in the furnace structure allowing the bath to be tilted for pouring. The primary coils consist of copper tube through which water circulates, a heavy current at low voltage being supplied by a separate transformer. A 5-ton furnace of this kind is in use at Jössingford. Lastly, the lecturer explained the operation of the Héroult pinch-effect furnace, which was described in the ELECTRICAL REVIEW of October 23rd, 1914.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER TRAINING CORPS.—Orders for Week commencing November 29th, 1915.—By Lieut.-Col. C. B. Clay, V.D, Commanding.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, November 29th.—Sections 1 and 2, Technical; Sections 3 and 4, Squad, Signalling Section and Recruits.

Tuesday, November 30th.—School of Arms with Architects' Corps, 6 to 8 p.m.

Wednesday, December 1st.—Opening of New Headquarters (see below), at 6.25 p.m.

Thursday, December 2nd.—Sections 3 and 4, Shooting.

Friday, December 3rd.—Sections 3 and 4, Technical; Sections 1 and 2, Squad, Signalling Section and Recruits.

The opening of the new Headquarters takes place on Wednesday, December 1st, at 6.25 p.m. All members are requested to attend in uniform if possible. Members are requested to bring as many recruits as possible on this occasion.

Members desirous of applying for commissions in the technical branches of the Army should apply immediately to the Commandant or Adjutant, who will give them all the information they require.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON REGIMENT (VOLUNTEERS).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, November 25th, 1915:—

Week-end Parades.—Saturday.—Field Operations. A company will parade at Baker Street Station at 2.30 p.m., and proceed by through train to Wembley Park. Umpires to accompany this party—Capt. Eastwood, Mr. H. O. King and the Adjutant. B, C and D Companies, rendezvous at Queen's Park Station, at 2.45 p.m., under the command of Mr. Ridd.

Instructions have been issued to the Officers concerned.

Sunday.—All day Outpost Scheme.

A, B, C and D Companies will parade at Wembley Park at 10.30 a.m. to be in position by 12 noon. North London and Blackheath Platoons will represent the Enemy, and will rendezvous under special instructions issued separately.

Refreshments to be supplied on the Ground by the Quartermaster for A, B, C and D Companies. North London and Blackheath Platoons to take their own provisions, and to provide themselves with a narrow white tape hat band.

Musketry.—There will be no shooting at Acton on Saturday next, the 27th inst.

Bisley.—The range will be open all day for members of the Corps. Names to be sent in to Headquarters, as usual. Members going down in the morning, should report to Sergeant Cotter at the barrier of No. 9 Platform, Waterloo Station, at 9.15 a.m. Those unable to travel at that time should apply for travelling vouchers at Headquarters not later than 5 p.m. on Friday next, the 28th inst.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Books for British Prisoners of War.—A further appeal is made by the Board of Education for books of an educational character for the British Civilian Prisoners of War (of whom there are some 4,000) now interned at Ruhleben, in Germany. Under the auspices of a Camp Education Department, a school and a Science and Art Union have been organised among the prisoners, and in them are enrolled 1,500 students with 150 lecturers and teachers. The educational work covers nearly all the usual subjects of a school or college curriculum. Persons willing to contribute either books or money to this interesting and most deserving effort to help our unfortunate fellow-countrymen in Germany to relieve in a profitable manner the tedium of their confinement, may obtain a circular giving full information on the subject, by addressing a post-card to Mr. Alfred T. Davies, Board of Education, Whitehall, London, S.W., who is in charge of the arrangements for obtaining and forwarding the books to Ruhleben.

Petrograd Electric Light Economies.—In order to save coal and electric power for the factories and workshops that are working for the national cause, the Governor of Petrograd, Major-General Prince A. N. Obolenky, decreed, on Oct. 11th last, the prohibition of the use of illuminated advertisements and sign boards, as well as the exterior lighting of houses (excepting lamps with numbers), industrial and trading concerns, restaurants, theatres, and entertainment houses. The posters fixed on such premises may be illuminated with one lamp having an incandescent light of not over 100 C.P. He prohibits the interior lighting of mercantile establishments whilst these are closed, excepting such lighting as is necessary for purposes of security; he also prohibits the use of arc lamps in shop windows, but such premises may use three incandescent lamps not exceeding 100 C.P. per lamp for each window. The lighting of entrances can only be allowed if the nearest street lamp does not suffice for such a purpose. Infringements of the decree will subject the offenders to imprisonment for a period up to three months, or to arrest for such period, or to a fine up to 3,000 roubles (about £320).

Accidents.—Mr. Wm. Sample, electrician, Dungiven, Co. Londonderry, while attempting to free an obstruction in the working of an engine at a generating station, had his arm caught in the machinery. The limb was badly lacerated.

The *Times* states that by an explosion due to an accumulation of gas in a ship at Wallsend, one man was killed, and five other workmen, all electricians, were injured.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Mr. E. S. RILEY, station superintendent at the Walthamstow U.D.C. electricity works, has resigned his position and enlisted in the Army.

The Holmfirth District Council has appointed Mr. A. C. BOTT resident electrical engineer.

At the electricity works, Stamford, recently, Mr. A. EMERTON, the fitter, was presented by the staff with a clock on the occasion of his marriage. Mr. J. E. Edmundson, the engineer, made the presentation.

Mr. H. M. TAYLOR having resigned his appointment as chief electrical engineer to the Middlesbrough Corporation, Mr. R. A. SCOTSON has been appointed his successor at £300 a year.

General.—Mr. B. SLEATH, who travels for Messrs. Venner & Co. and for their principals, Messrs. Chamberlain and Hookham, Ltd., in the West of England and South Wales, and Mr. J. S. CARTER, who has recently been travelling in many parts of the world for Messrs. Chamberlain and Hookham, Ltd., have both joined the Motor Transport Section of the A.S.C., and are at present stationed temporarily at Grove Park.

In consequence of the absence of Captain Wallis-Jones on active service, Mr. HAROLD W. COUZENS, of the firm of Couzens & Brown, has kindly undertaken to execute, on behalf of Messrs. Wallis-Jones & Dent, Westminster, all work now in hand and any future work that may be entrusted to that firm. Mr. Couzens will have the services of Mr. Tate, for so many years the firm's chief assistant engineer. The firm's address is: 50, Queen Anne's Gate, S.W. Telephone number: Victoria 5029.

Since our last issue more municipal bodies in Lancashire have appointed committee chairmen for the ensuing year as follows:—

Salford.—Electricity Committee, Coun. G. BILLINGTON (chairman) and Coun. McDOUGALL (vice-chairman); Tramways Committee, Ald. LINSLEY (chairman) and Coun. BARRETT (vice-chairman).

Oldham.—Electricity Committee, Coun. C. HARDMAN (chairman) and Ald. WARD (vice-chairman); Tramways Committee, Ald. ISHERWOOD (chairman) and Coun. ELLIOT (vice-chairman).

Bury.—Electricity Committee, Coun. JAMIESON (chairman) and Coun. T. HOLT (vice-chairman); Tramways Committee, Ald. COLLINGE (chairman) and Coun. HARGREAVES (vice-chairman).

Preston.—Tramways Committee, Ald. OMEROD (chairman) and Coun. PARKINSON (vice-chairman).

Southport.—Tramways Committee, Ald. GRIFFITHS (chairman) and Coun. CLAYTON (vice-chairman).

Stockport.—Electricity Committee, Ald. GEORGE BALL (chairman) and Coun. J. W. BOOTH (vice-chairman); Tramways Committee, Ald. C. SHARPLES (chairman) and Ald. W. E. HAMNETT (vice-chairman).

Mr. T. PERRIN has been re-elected chairman of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, and Mr. H. SYKES has been re-elected vice-chairman.

Coun. A. J. BECKETT has been appointed chairman and Coun. J. BAVIN vice-chairman of the Fulham B.C. Electricity Committee.

Mr. BRUCE LINDSAY has been elected Convener of the Edinburgh Corporation Electric Lighting Committee.

Ald. VORLEY has been appointed chairman and Ald. MYERS vice-chairman of the Islington B.C. Electricity Committee.

Coun. BROOK has been appointed chairman of the Electricity Committee of the Todmorden T.C.

Mr. H. R. BARGE and Mr. W. F. BATE have been appointed chairman and vice-chairman respectively of the Poplar B.C. Electricity Committee.

Mr. ARTHUR BRIDGE has been appointed chairman of Battersea B.C. Electricity Committee for the ensuing three months.

The friends of Mr. A. V. GIFKINS, the well-known electrical contractor who was so seriously injured on the night of October 13th, will be pleased to hear that he is making excellent progress, and hopes to leave the hospital within the next fortnight. In the meantime, he tenders his most sincere thanks to the very large number of those who have written to him expressing their sympathy, and hopes to deal more fully with their letters at a later date.

Mr. H. PERKINS, electrical traveller in the Midlands and the Eastern Counties for Messrs. Falk, Stadelmann & Co., Ltd., has joined the Royal Engineers, Electrical Section, for the duration of the war. He will resume his duties with the firm after the war.

Mr. C. F. ANDERSON has resigned his position with the B. & K. Co. to join the 26th Royal Fusiliers.

The following notice appears in the *London Gazette*:—Territorial Force, Tyne Electrical Engineers: Richard Garratt Ellis to be Second-Lieutenant, September 15th, 1915.

M. GEORGES CLAUDE, the inventor of the neon lamp, has been made a Chevalier of the Legion of Honour, and awarded the War Cross. He is a lieutenant in the air service.—*Lumière Electrique.*

Mr. J. W. MEARES, electrical adviser to the Government of India, is to proceed on seven months' leave this week. Mr. C. C. T. Eastgate, electric inspector, Punjab, will officate in Mr. Meares's absence.

Mr. THOMAS A. EDISON has recently been appointed Chairman of the Naval Advisory Board, U.S.A., which Board comprises a number of prominent engineers and scientific men of U.S.A. Dr. WILLIS R. WHITNEY, Ph.D., Director of the Research Laboratory of the General Electric Co., Schenectady, New York, has been appointed a member of the same Board. Among the many important developments and inventions made in the above laboratory under Dr. Whitney's direction have been the drawn-wire tungsten filament and the gas-filled (half-watt) lamp. Dr. W. L. R. EMMET, chief engineer of the lighting department of the General Electric Co. (U.S.A.), Schenectady, has also been appointed a member of the Naval Advisory Board. Dr. Emmet is a graduate of the United States Naval Academy, and served as an officer in the United States Navy, which position he resigned to take up engineering work with the General Electric Co. (U.S.A.) at their Schenectady works. He was responsible for the development of the Curtis steam turbine as applied to the driving of electric generating machinery, and was specially engaged on this work for a number of years. His most recent development is the mercury vapour turbine, a paper on which was presented before the American Institute of Electrical Engineers during the past year.

Mr. ERNEST W. DUNTON, of the British Thomson-Houston Co., Ltd. (Madza House staff), has been appointed electrical engineer to the Anglo-Saxon Petroleum Co., Ltd., for service in Sarawak, and he is leaving this country very shortly to take up his new post and erect the electric lighting plant at Sarawak, and afterwards take charge, in accordance with the plans and specifications of the consulting engineers for the scheme, Messrs. Albion T. Snell & Partners.

Roll of Honour.—Private ALFRED GRIFFITHS, who, before the war, was in business as an electrical engineer in Manningham Lane, Bradford, and has been serving in the Motor Transport Section of the Army Service Corps, has died of wounds received whilst on service in France.

Corporal LEONARD S. NEWNS, of the Royal Flying Corps, formerly a wireless operator, has been awarded the D.C.M. for gallant conduct and coolness when carrying out his duty under fire, and for the conspicuous thoroughness and efficiency for which his work has been noticeable.

Private ARCHER WATSON, of the 6th Battalion Lincolnshire Regiment, who is reported massing, was, prior to enlistment, engaged with Messrs. Cutting Bros., electrical engineers, of Stamford. He was present at the Suvla Bay landing at the Dardanelles, and although previously reported wounded, no news of him has been received since August 6th.

Sergeant CHAS. L. R. HAINES, of the Royal Engineers, who has died at Netley Hospital from shrapnel wounds received in action on September 25th at Loos, was formerly engaged at the Rugby works of Messrs. Willans & Robinson, Ltd.

Lieutenant C. P. B. OGILVIE, Mechanical Transport Section, Army Service Corps, has been wounded in France, and is now in the British Red Cross Society's Hospital, at Eastbourne, with a bullet wound in the head. Prior to the war he was an electrical and motor engineer in Belfast.

Obituary.—DR. PAUL RASEHORN.—The death is reported from Berlin, at the age of 50 years, of Dr. Paul Rasehorn, the chief engineer of the Siemens & Halske Co.

DR. HENRY CHARLTON BASTIAN.—We tender to Mr. C. Orme Bastian our sincere sympathy on the occasion of the death of his noted father, Dr. Henry Charlton Bastian, which occurred in his 79th year on Wednesday last week.

EX-BAILIE JAMES ALSTON.—Ex-Bailie J. Alston, who a fortnight ago was appointed Convener of the Glasgow T.C.'s Tramways Committee, died at his residence, Carmunnock, Busby, this week.

MR. FRED. HAWKINS.—The death occurred on 18th inst., at the age of 86 years, of Mr. Fred. Hawkins, who was in the employ of the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., for 60 years. He joined the company when it was known as S. W. Silver & Co., and served almost continuously until within a few weeks of his death. He was for many years manager of the cable-making and battery department. The funeral ceremony took place on Wednesday at West Ham Cemetery. With the death of Mr. Hawkins there has passed away another of the highly-esteemed old guard of Silvertown whose departure we record with feelings of personal regret.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Renew Electric Lamp Co., Ltd.—Mortgage dated November 17th, 1915, to secure £337 7s. 3d., and further advances up to £500, charged on the benefit of a certain agreement, being a contract for the purchase of a licence to work the company's process for renewing electric lamps in Russia. Holders: Haughton, Dickson & Co., Ltd., 3, Mumford Court, Milk Street, E.C.

Llangollen and District Electric Light and Power Co., Ltd. (75,384).—Capital, £6,000 in £1 shares (2,500 pref.). Return dated September 21st, 1915. 2,114 shares taken up; £2,110 15s. paid, leaving £3 5s. in arrears. Mortgages and charges: £2,800.

Halifax and Bermudas Cable Co., Ltd. (28,972).—Capital, £50,000 in £5 shares. Return dated September 30th, 1915. All shares taken up; £50,000 considered as paid. Mortgages and charges: Nil.

New Liverpool Rubber Co., Ltd. (109,933).—Capital, £150,000 in £1 shares (52,000 pref.). Return dated October 13th, 1915. 58,502 ord. and 51,410 pref. shares taken up; £58,502 paid; £51,410 considered as paid. Mortgages and charges: £25,765.

North Melbourne Electric Tramways and Lighting Co., Ltd. (55,463).—Capital, £200,000 in £1 shares (100,000 pref.). Return dated July 16th (filed September 2nd), 1915. 67,257 pref. and 100,000 ord. shares taken up; £52,257 paid; £115,000 considered as paid. Mortgages and charges: £167,000.

CITY NOTES.

Edison & Swan United Electric Light Co., Ltd.

Mr. C. J. Ford presided, on November 18th, at the annual meeting held at Winchester House, E.C. In referring to the balance sheet, he said that the item of sundry creditors and credit balances stood at £80,814, against £48,174 last year. The increase was wholly due to the larger turnover, and was correspondingly represented on the other side of the account by increases in the items of stock and sundry debtors, the first of which had increased from £184,989 in 1914 to £211,273, and the debtors from £64,831 to £89,792. With a view to extending the company's manufacturing facilities, £8,690 had been expended on additional buildings to cope with the increased trade, which expenditure was included under the item of freehold and leasehold property, which now stood at £73,036. Plant and machinery for a similar reason had been increased by £8,700, bringing that item up to £84,613. One of the principal items included in that additional expenditure had been in respect of their glass furnaces, which were now equipped for an output of lamp bulbs of practically double the capacity which existed heretofore. Whilst on that subject, he might tell them that they had in the past year found no difficulty whatever in disposing of the whole of their output, and could undoubtedly have sold more if their manufacturing capacity had been greater; but it was only within the last few months that the additional furnaces and plant had been available, and further moderate expenditure would be required. In normal times the sales of lamps they had made would undoubtedly have shown them a considerably greater profit, but they were in the position that the selling price of the drawn-wire lamp could not be increased; in fact, it was more likely to be reduced. On the other hand, the cost of manufacture had risen to an abnormally high figure in consequence of increase in wages and the cost of raw material. Anyhow, the company had undoubtedly established the reputation of the "Ediswan" drawn-wire lamp, and unless something altogether unforeseen should happen in the future he saw no reason why the increased sales should not continue. With regard to the company's interest in the Altrincham Electric Supply, Ltd., the last balance sheet showed a holding of 10,060 fully-paid preference shares, and 5,000 similar shares on which a small amount had been paid, together with 6,669 deferred shares of 1s. each. In the present accounts it would be seen that they held in June 4,705 fully-paid and 5,000 10s. paid preference shares, the difference having been sold in the period under review. They had since disposed of the whole of the partly-paid shares, thereby cancelling £2,500 of the £2,785 liability referred to in the balance sheet, and they had reduced their holding in fully-paid preference shares to 1,505. With regard to the deferred shares in the Altrincham Co., of which they held the whole issue except one, they were, in the opinion of the board, a valuable asset, and when he told them last year that their dividend thereon amounted to 10s. per share they would agree with him. It they capitalised these shares to pay 10 per cent., which he did not think was unreasonable, their holding should be worth over £33,000. This would mean that they were worth £5 per share, but the difficulty was to obtain the price for them. The public would willingly pay £1 for a £1 share paying 10 per cent., but looked askance at paying £5 for a share of the face value of 1s. He did not think the dividend in the future on these shares should be less than that received in the past. The general expenses had been reduced by £4,825, and amounted to £17,038, and the balance of gross profit brought from trading account had been increased from £51,244 to £56,962, the net result being that they had made a profit for the year of £14,146, against £4,695 last year. He regretted that they could not recommend the payment of a dividend, but on previous occasions he had pointed out that it was absolutely essential before any dividend was paid that they should accumulate a very substantial reserve fund and employ it as additional working capital. For this reason they recommended that a start be made by transferring £15,000 to reserve account. During the year they had had an anxious and trying time, and had experienced great difficulty in finding adequate labour. Their anxieties had been accentuated by reason of the great rise in the price of raw materials, and in many instances the difficulties of obtaining them, even at any price, which, coupled with the heavy rise in the price of labour, had tended at times to severely tax their financial resources. If the business increased in the future as it had during the past two years, the question of finance would become a still more urgent one. Unfortunately, there did not appear to be any existing means of providing further working capital except through the medium of holding up profits. One of his colleagues, Mr. Gimingham, in the early part of the year made a tour of inspection of the company's Australian and New Zealand branches and agencies, and visited the chief commercial centres there, and he thought that in due course a considerable expansion of the company's trade in Australia should result therefrom. In conclusion, the Chairman referred to the nomination of Mr. John Cross to a seat on the board, and explained that several large shareholders considered that no addition should be made at present, and consequently Mr. Cross withdrew his candidature.

Mr. E. B. Ellice Clark seconded the motion.

In the course of his reply to remarks by shareholders, the Chairman said that the public seemed to think that because a concern was doing a huge trade it was necessarily making a huge profit. That might be the case in normal times, but not in such times as the present. As an instance, he might tell them that they had had to send their own motor vans to Birmingham from London to fetch metal. Wages had gone up after contracts had been secured to a very high figure indeed, and raw materials had also gone up after contracts had been made. It was impossible for any business of that sort to cover itself absolutely for the whole of the contracts it had in hand. They could do it to a certain extent, but they would want a colossal amount of working capital if they were to do so entirely. Although they had a very big business, there had not been the profit that might have been expected. Lamps were practically their main article, and the price of the lamp was fixed and could not be raised, whilst the cost of producing the lamp had gone up 33 per cent.

Mr. Lowry asked if there was any prospect in the coming year of a dividend being paid, or of the contracts they had entered into, and which had not been profitable, being put on a better basis?

The Chairman said he could not forecast anything about a dividend. He had put it plainly that day, and in the past, that no dividend could be paid until they had got sufficient working capital, and this could necessarily only be provided out of profits. He saw no possibility of a dividend until they had at least £50,000 reserve. When he became chairman there was a sum of £45,000 put down in the reserve account, but on looking into the whole matter most carefully he found it had been accumulated out of so-called profits made by not adequately depreciating stock. If the stock had been taken at the proper figures the profit would not have existed as shown, and consequently they would not have had the £45,000 reserve at all. The profit shown that day was after taking stock and debtors and all their assets at the most conservative figure, and there was no doubt about it that they had the profit there. They had not taken any contracts which were not profitable. What he intended to convey was that they were not as profitable as in normal times.

The report was then adopted.

Allgemeine Elektricitats Gesellschaft.

The directors of the A.E.G., of Berlin, have issued a statement referring briefly to the working results in the year ended with June 30th, 1915. It announces that the workshops, from which 23,908 employés were absent owing to the call to the Army, were adequately occupied on peace work, and were at disposal for the defence of the country to a wide extent. The bank credit is claimed to have amounted to £5,165,000 at the end of the year, as against £3,850,000 in 1913-14. The sum expended for the support of the families of employés reached £230,000 in the first year, and had been defrayed out of revenue. The book value of a number of industrial investments had been written down by £100,000, so as to bring them to the nominal value. After deducting general expenses, taxes, interest on loans, and provision for depreciation, the accounts are said to show net profits amounting to £1,069,000, as contrasted with £944,000 in the preceding financial year. It is proposed to pay a dividend of 11 per cent. on the ordinary share capital of £7,750,000, as compared with 10 per cent. in 1913-14 and 14 per cent. in each of the two preceding years. It is added that the recent increase of £1,450,000 in the share capital had been registered after shares for £1,738,000 in the Berlin Electricity Works Co. had been notified in exchange for A.E.G. new shares for £1,303,000, and the balance of £147,000 had been taken over by a banking syndicate. A proposal to amend the company's statutes is to be made at the forthcoming general meeting, so as to extend the objects of the undertaking.

Southern Brazil Electric Co., Ltd.

Mr. E. H. Tootal presided at the annual meeting, held in London on 22nd inst. He referred to the valuable assistance rendered by the company's brokers throughout an anxious and trying period. They had been compelled to husband their resources, and delay and curtail the development and extension work contemplated, until their finances were placed upon a better footing. The balance of £2,127, which was to be carried forward, did not represent the result of a full year's working, for in the case of Campinas, Paranagua, and Byington & Co., which closed their accounts on December 31st, only profits for the six months ended December, 1914, had been taken into account. It was proposed to alter the date of closing the company's financial year so as to coincide with that of the Brazilian concerns. The report was adopted.

Provincial Tramways Co., Ltd.—The report for the year ended September 30th, 1915, states that the net revenue received from the local companies has been £48,789, against £40,297 last year and £41,683 in 1913. The directors have set aside to reserve and depreciation account £12,000, and have added to reserve account for third party insurance or other purposes £4,000. They now recommend a dividend on the £1 ordinary shares of 10d. per share, making with 8d. per share paid in June last 1s. 6d. per share, or 7½ per cent. for the year, leaving £11,800 to be carried forward. Having regard to the uncertainty of the current year as to traffic, and also as to the probability of greatly increased taxation, the directors consider it prudent to carry forward this substantial amount.

Mexico Tramways Light and Power Companies.—At the request of the holders of large amounts of the bonds of the various companies constituting the Mexico Tramways, Light and Power group, the following gentlemen will act as a committee to co-operate with the trustees, the receivers, and the boards of directors, in taking such measures from time to time as will best safeguard the interests of the security holders:—Mr. E. R. Peacock (chairman), Messrs. Stanley Boulter, H. F. Chamen, Robert Fleming, H. Malcolm Hubbard, and A. F. P. Roger.

Richard Hornsby and Sons, Ltd.—For the year ended September 30th there was a disposable balance amounting to £52,762, as compared with £25,745 for the previous year. A distribution of 6½ per cent. on the ordinary shares is recommended, as compared with 2½ per cent., carrying forward £27,547.

Callender's Share and Investment Trust, Ltd.—The directors recommend a dividend at the rate of 5 per cent. per annum, less income-tax, for the half-year, making 5 per cent. for the year, placing £500 to reserve, writing £741 off preliminary and other expenses, and carrying forward £3,010.

Electric Construction Co., Ltd.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year to September 30th.

Victoria Falls and Transvaal Power Co., Ltd.—The net earnings, including those of the Rand Mines Power Supply Co. for the quarter ended September 30th, amounted to £184,798.—*Financial Times.*

Power-Gas Corporation, Ltd.—A dividend on the ordinary shares for the year ended September 30th last at the rate of 6 per cent. per annum, less income-tax, is announced.

Ruston, Proctor and Co., Ltd.—An interim dividend of 2½ per cent. is announced.

Anglo-Portuguese Telephone Co.. Ltd.—The directors announce an interim dividend of 3 per cent., less income-tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange business is moving on lines rather slower than those which have distinguished it during the first half of the month. For this the vacillation of Greece and the advance of the enemy into Serbia are in the main responsible, having combined to check investment and to lay a hand upon the spirit of optimism which had been current previously in most of the Stock Exchange markets.

At the same time, the Treasury have just introduced an unexpected factor into Capel Court conditions, because, taking the Stock Exchange by surprise, they have given permission for minimum prices to be removed in the cases of Consols and various other fixed-interest securities which have lain under the shelter (or the ban, from whichever point of view one looks at it) of the Treasury regulations since January 4th last. It will be recalled that the Treasury practically sold to the Stock Exchange the privilege of reopening the House, in exchange for certain severe restrictions, of which the establishment of minimum prices in scores of stocks formed one of the number. We dealt fully with the matter at the time, and have recurred to it on subsequent occasions when indicating the mechanical difficulties under which Stock Exchange transactions at present creak.

The Treasury have removed these restrictions from only certain stocks, of which Consols are the chief. None of the Home Railway fixed-interest issues—*e.g.*, Metropolitan District prior lien debenture, Central London 4½ per cent. preference, London Electric 4 per cent. debenture—are affected, although it is thought probable that if the removal of the minima from Consols, Foreign Government bonds, and the like, should turn out to be a discreet step, the Home Railway prior-charge lists will shortly be brought into line with the rest. Consols promptly fell 7 points from their previous minimum, so it may be guessed what would happen if Railway stocks were freed entirely.

The feature in the Home Railway market this week is another substantial rise in Underground Electric 6 per cent. income bonds, the price of which has jumped up 4 points to 78½, while the £10 shares rose to 40s. and the shilling shares to 6s. 7½d. We take no credit to ourselves for pointing out the obvious cheapness of the bonds when they stood in the neighbourhood of 70, because there was so little reason for the overdone depression, and so much likelihood of its being rectified. The advance has been assisted by various rumours, one of which hears that fares are going to be raised on the Underground Electric Railways and omnibus systems; and if this is so, the security of the income bonds would certainly be improved, because, in present conditions, a slight advance in fares would make little perceptible alteration in the number of passengers, although the total carried is so enormous that a scarcely-felt rise in the price of a ticket would make a huge difference to the aggregate receipts of the associated companies.

Districts and Metropolitans are both better, Central Londons gained 2½, and most of the Steam stocks present a more healthy appearance than they have been doing of late. This is consequent upon a little investment inquiry by those who regard the stocks as cheap, seeing that current prices are full of the dividend earned during nearly five months of the fat half of the year.

How the provinces are making money and putting it by—at all events, some proportion of it—is seen in the constantly-increasing difficulty of obtaining good-class stock at the present range of prices. Anglo-Argentine Tramways debenture stocks make a good illustration. Not long ago, it was difficult to get a bid for the 5 per cent. debenture issue; now, the trouble is to get the offer of it. The same remark applies to one market after another throughout the Stock Exchange. The public want sound securities paying 5½ to 6 per cent. on the money, but holders are apparently not eager to sell, nor obliged to do so.

Go into whatever market one may choose, the really good investments are only to be picked up—at attractive prices, that is—more or less by accident. "We cannot get stock," murmured a jobber the other day, "until a few more holders die"; and the grim comment gives an effective idea of the principal source from which supplies are to be expected. New issues cannot be made; foreign holders cannot sell; some of the provinces are prospering by reason of the war, and so there is not enough good stock to go round.

There is not much doing in the market for domestic electrical shares. No changes have occurred in prices; and, although a few buyers come in occasionally for the preference issues, the ordinary shares are still neglected. London Electric 4 per cent. debenture has gone back 3 points to 77, but this is exceptional, because for most of the good debenture stocks there is demand and no supply.

Telegraph stocks are mostly good. The Eastern group is better, and both classes of Globe Telegraph and Trusts have risen ¼. Western Telegraphs hardened to 12½. New York Telephone bonds remain at 101¼, but the market for most American securities is a little shaky in consequence of a rise in the exchange. American Marconis receded to 16s. 6d., while the price of the parent shares, at 37s. 6d., is also lower. Anglo-American Telegraph deferred at 22¾ has gone back ¼, and at the present price it looks tempting, by reason of the excellent yield that it affords.

Mexicans are looking more healthy again, and some of the utility issues are a point or so better on the week, this applying rather to the common and preferred stocks, because the bonds are offered. Brazil Tractions stick at 57½. To our price lists over-leaf we add four of the most negotiable stocks of the British Columbia Electric Railway. The company has so far paid the full dividend on its 5 per cent. preference stock, but whether this performance will be repeated in respect of the current half-year is considered highly doubtful. Castner-Kellners are good at 3½, Babcock & Wilcox are retaining all their firmness, British Westinghouse preference put on a florin, Electric Constructions rose 1s. to 14s., and there has been an improvement in Telegraph Constructions.

The rubber share market was buoyant until the price of the raw stuff bounded up to 3s. 7d. a pound. This was held to be a significant red light, showing the danger of buying overmuch in a market where the inflation of the raw stuff began to wear a very artificial aspect. Difficulty in securing ships for transport of the rubber to the United States and to these shores, plus the renewed activity of the German submarines in the Mediterranean, are holding up large quantities of rubber in the Middle East; and although the companies producing rubber at 1s. per lb. or less would be making huge profits if they could get anything like 3s. 6d. per lb., it is not clear that in the majority of cases they are able to obtain it from their estates. So that, while the prices are good, the buying is more cautious than it was ten days ago; and it seems to us that the careful attitude is eminently correct.

In copper shares, the tendency is rather reactionary. The United States has had a bearish fit in consequence of a rise in exchange between New York and London, but this phase is not likely to be more than temporary; prices will probably recover again, whatever the exchange happens to be. Armament shares are also quiet, and as a whole, though keeping on a steady keel, they fail to attract any noteworthy attention.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Nov. 23, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£6 18 4
do. 7 per cent. Pref.	7	7	—	5 0 0
Charing Cross Ordinary	5	8½	—	7 2 10
do. do. do. 4½ Pref.	4½	8½	—	6 0 0
do. do. City Pref.	4½	8½	—	6 8 7
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 17 8
do. 4½ Deb.	4½	87	—	5 8 6
City of London	9	12½	—	7 7 3
do. do. 6 per cent. Pref.	6	10½	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10½	—	5 17 8
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	83 xd	—	5 8 0
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	7 1 2
do. do. 4 Deb.	4	77	−3	5 4 0
Metropolitan	8½	2½	—	7 15 7
do. 4½ per cent. Pref.	4½	3½	—	6 0 0
do. 4½ Deb.	4½	85	—	5 6 0
do. 5½ Deb.	5½	70	—	5 0 0
St. James' and Pall Mall	10	6½	—	7 13 10
do. do. do. 7 per cent. Pref.	7	6	—	5 16 8
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	6	2½	—	6 19 0
South Metropolitan Pref.	7	1 7/8	—	6 14 0
Westminster Ordinary	9	6½	—	6 18 6
do. 4½ Pref.	4½	4½	—	5 9 0
Telegraphs and Telephones				
Anglo-Am. Tel. Pref.	6	10 ⅜	—	5 18 0
do. Def.	1½	22⅝	− ½	6 11 10
Chile Telephone	8	6½	—	6 8 0
Cuba Sub. Ord.	5	8	—	6 6 0
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	12	+ ⅛	*6 13 3
do. 4 Deb.	4	80	—	5 0 0
Eastern Tel. Ord.	7	125	+1	*6 8 0
do. 8½ Pref.	8½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	10⅜	—	*6 13 2
do. Pref.	6	10⅜	—	5 15 8
Gt. Northern Tel.	22	83½	—	6 11 4
Indo-European	12	46 xd	—	6 18 4
Marconi	10	1⅞	− 1/32	5 6 8
New York Tel. 4½	4½	101¼	—	4 8 9
Oriental Telephone Ord.	10	1 7/8	—	5 8 1
do. Pref.	6	⅜	—	6 17 2
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅝	—	*8 2 6
do. Pref.	6	4⅛	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	12½ xd	+ ⅛	*6 8 0
do. 4 Deb.	4	80	—	5 0 0
Home Rails				
Central London, Ord. Assented	4	70½	+ 2½	5 13 6
Metropolitan	1½	55	+ ½	5 0 0
do. District	Nil	15	+ ⅛	Nil
Underground Electric Ordinary	Nil	2	+ ⅛	Nil
do. do. "A"	Nil	6/7½	+1/7½	Nil
do. do. Income	6	78½	+4	*8 16 1
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do 5 Deb.	5	97	—	5 3 0
Anglo-Arg. Trams, First Pref.	5½	4	—	6 17 6
do. 2nd Pref.	5½	8½	+ ⅛	7 17 2
do. 4 Deb.	4	76	—	5 5 3
do. 4½ Deb.	4½	75	—	6 5 0
do. 5 Deb.	5	82	+2	6 2 0
Brazil Tractions	3½	57½ xd	—	6 1 9
Bombay Electric Pref.	6	10½	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
British Columbia Elec. Rly. Pfce.	5	53	—	9 11 4
do. do. Preferred	—	37	—	Nil
do. do. Deferred	—	33	—	Nil
do. do. Deb.	4½	62	—	6 17 1
Mexico Trams	Nil	42	+2	Nil
do. 5 per cent. Bonds	—	49	−1	Nil
do. 6 per cent. Bonds	—	44	—	Nil
Mexican Light Common	Nil	30	—	Nil
do. Pref.	Nil	42	+2	Nil
do. 1st Bonds	—	49	−1	—
Manufacturing Companies.				
Babcock & Wilcox	14	9 7/8	—	6 1 9
British Aluminium Ord.	5	1 7/8	—	4 14 1
do. Pref.	6	18/8	—	6 9 9
British Insulated Ord.	15	10½	—	7 8 2
do. Pref.	6	5½	—	5 2 2
British Westinghouse Pref.	7½	86/-	+2/-	8 6 8
do. 4 Deb.	4	70	−2	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	10½	—	7 2 10
do. 5 Pref.	5	4½	—	5 11 8
do. 4½ Deb.	4½	85	—	5 6 0
Castner-Kellner	20	8½	—	6 8 0
Edison & Swan, £8 pd.	Nil	9/-	−1/-	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	57	—	7 0 4
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	14/-	+1/-	8 11 6
do do. Pref.	7	1s/9	—	7 1 4
Gen Elec. Pref.	6	9½	—	6 6 4
Henley	20	12¾	—	*8 19 4
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	7⅞	—	6 5 0
Telegraph Con	20	31	+ ½	*8 1 6

*Allowance made for dividends being paid free of income-tax.

Dublin Electricians' Strike.—The Dublin electricians who struck for higher wages, returned to work on Tuesday at the old rate of pay, pending arbitration, at which the Recorder of Dublin (Right Hon. T. L. O'Shaughnessy) will preside.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, November 24th.

CHEMICALS, &c.		Latest Price.	Fortnight's (inc. or Dec.
a Acid, Hydrochloric	per cwt.	..	..
a " Nitric	"	..	..
a " Oxalic	per lb.	1¼	..
a " Sulphuric	per cwt.	..	..
a Ammoniac Sal	"	..	..
a Ammonia, Muriate (large crystal)	per ton	£50	..
a Bleaching powder	"	..	..
a Bisulphide of Carbon	"	£23	..
a Borax	"	£23	..
a Copper Sulphate	"	£42	£6 10 inc.
a Lead, Nitrate	"	..	..
a " White Sugar	"	..	..
a " Peroxide	"	..	..
a Methylated Spirit	per gal.	..	..
a Potassium, Bichromate, in casks	per lb.	..	..
a Potash, Caustic (88/90 %)	per ton	..	..
a " Chlorate	per lb.	1/4½	..
a " Perchlorate	"	1/6	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	"	Nom.	..
a Shellac	per cwt.	65/-	..
a Sulphate of Magnesia	per ton	£18	..
a Sulphur, Sublimed Flowers	"	£11 10	..
a " Recovered	"	..	..
a " Lump	"	£8 10	..
a Soda, Caustic (white 70/72 %)	"	..	..
a " Chlorate	per lb.	1/3½	..
a " Crystals	per ton	45/-	..
a Sodium Bichromate, casks	per lb.	6½d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	..	..
b " Wire, in ton lots (1 to 14 S.W.G.)	"	..	..
b " Sheet, in ton lots	"	..	..
g Babbitt's metal ingots	"	..	..
c Brass (rolled metal 2" to 12" basis)	per lb.	1/1½ to 1/2	½d. inc.
c " Tubes (solid drawn)	"	1/2½ to 1/2¾	½d. inc.
c " Wire, basis	"	1/2 to 1/2½	½d. inc.
c Copper Tubes (solid drawn)	"	1/2½ to 1/2¾	½d. inc.
g " Bars (best selected)	per ton	£112	£5 inc.
g " Sheet	"	£112	£5 inc.
g " Rod	"	£112	£5 inc.
d " (Electrolytic) Bars	"	£97	£4 inc.
d " " Sheets	"	£115	£6 inc.
d " " Rods	"	£104	£4 inc.
f " " H.C. Wire	per lb.	1/3½	1/32d. inc.
Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
German Silver Wire	"	1.10	..
b Gutta-percha, fine	"	6/10	..
b India-rubber, Para fine	"	8/-	4½d. inc.
f Iron Pig (Cleveland warrants)	per ton	71/6	3/10½ inc.
f " Wire, galv. No. 8, P.O. qual.	"	£28	£2 inc.
g Lead, English Pig	"	£24 10	£2 15 inc.
g Mercury	per bot.	£16 15	..
c Mica (in original cases) small	per lb.	6d. to 8/-	..
c " " " medium	"	8/6 to 6/-	..
c " " " large	"	7/6 to 14/- & up.	..
c Nickel, sheet, wire, &c.	"	Nom.	..
p Phosphor Bronze, plain castings	"	..	..
p " " rolled bars & rods	"	..	..
p " " rolled strip & sheet	"	..	..
e Platinum	per oz.	210/-	12/- inc.
d Silicium Bronze Wire	per lb.	1/3	..
r Steel, Magnet, in bars	per ton	£85	..
g Tin, Block (English)	"	£165 10 to £166 10	£3 10 inc.
n " Wire, Nos. 1 to 16	per lb.	2/8	1d. inc.
p White Anti-friction Metals	per ton	..	..
k Zinc, Sh's (Vieille Montagne bnd.)	"	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

An Empire Fair.—We have received a copy of the preliminary prospectus of the Industries of the Empire Fair, 1917. The title may be clumsy, and while war is raging 1917 may seem a long way off, but for the information of those interested, we may say that it is proposed to hold the event at Willesden Green, and copies of the pamphlet before us may be obtained at Lincoln House, High Holborn, W.C. If peace is proclaimed by the date named, the event may be timely.

Industrial Diseases.—In the report of the Medical Inspector of Factories for 1914 it is stated that 41 cases of lead poisoning occurred in connection with the manufacture of electrical accumulators, compared with 44 in the previous year. The claim of Sir Thomas Oliver that lead could be eliminated from the body with the aid of the electric bath has been investigated, and is regretfully dismissed as groundless, the experiments failing to show that any practical benefit was derived from the treatment. There were 21 cases of poisoning by carbon monoxide from power plants, the same number as in 1913; none of them were fatal.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING OCTOBER, 1915.

We publish herewith the October figures of electrical export and import business.

As regards the former, it will be noted that they show a satisfactory improvement over the previous monthly returns, the totals for the last three months being: October, £406,132; September, £374,418; August, £346,318.

The electrical imports, on the other hand, have gone back considerably as compared with September, the October total of £146,281, being a substantial drop on the previous month's total of £211,488.

The re-exports, at £20,122, show a small advance on the September total of £19,885. The outstanding feature of the exports was the large machinery export amounting to over £161,000, and advances were also shown in telegraphic, battery and instrument exports; a considerable drop occurred in the value of cable exports, which, however, reached £85,000 in value.

The falling-off in electrical imports was fairly general in character, although mainly due to the much smaller value of American material entering this country, the U.S. being responsible for only £87,379 worth, as compared with £127,379 worth in September. An exception to the rule was Holland, which did a considerably increased business with us, including £12,536 worth of lamps imported into this country.

Our best customer during the month was India, but export business was better than usual in almost all directions.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	3,538	22,700	220	48	839	2,059	6,433	11,903	254	228	4,655	4,236	57,093
German West Africa	...	...	...	...	...	...	...	...	...	...	...	43	43
Netherlands, Java and Dutch Indies ...	206	8,661	719	11	...	172	956	...	1,080	...	764	205	12,774
Belgium	23	...	...	...	...	...	60	...	...	...	...	...	83
France	1,514	...	509	62	108	79	6,832	6,037	1,476	...	769	5	17,391
Portugal	22	3,266	409	117	...	248	206	...	120	48	1,506	31	5,973
Spain, Canary Isles and Spanish N. Africa...	357	11	143	33	...	186	2,244	503	...	69	266	3,374	7,186
Switzerland, Italy and Austria-Hungary ...	672	180	204	47	...	478	1,204	...	...	112	283	...	3,180
Greece, Roumania, Turkey and Bulgaria ...	44	37	20	196	...	...	199	278	...	...	30	160	964
Channel Isles, Gibraltar, Malta and Cyprus...	142	307	76	146	...	...	...	...	74	...	177	14,692	15,614
U.S.A., Philippines and Cuba	68	...	19	23	...	...	5,440	4	291	...	304	2,394	8,543
Canada and Newfoundland	192	20	306	129	...	684	2,260	...	291	...	38	986	4,906
British West Indies and British Guiana ...	124	133	38	81	39	...	...	...	24	68	65	92	664
Mexico and Central America	...	63	...	20	...	140	258	...	...	...	...	45	525
Peru and Uruguay	3	68	32	44	...	...	14	...	39	16	89	18	323
Chile	19	554	63	45	...	297	1,362	4,200	77	73	200	18	6 908
Brazil	119	172	210	229	...	10	488	14	90	11	...	...	1,343
Argentina	1,656	1,212	1,317	712	...	890	27,251	234	949	11	3,884	733	38,849
Colombia, Venezuela, Ecuador and Bolivia...	39	46	...	...	...	...	9	...	32	9	33	...	168
Egypt, Tunis and Morocco	198	340	48	252	...	28	602	5	325	...	478	477	2,753
British West Africa	...	55	26	42	...	...	269	1,200	74	...	67	240	1,973
Rhodesia, O.R.C. and Transvaal	273	3,267	499	1,300	...	181	469	243	1,494	...	172	...	7,898
Cape of Good Hope	619	1,811	280	978	...	832	412	1,400	1,318	65	1,037	205	8,957
Natal	38	2,703	191	124	...	...	9,223	...	41	20	92	38	12,470
Zanzibar, Brit. E. Africa, Mauritius & Aden	71	...	35	34	...	...	923	...	69	...	16	173	1,321
Azores, Madeira and Portuguese Africa ...	37	75	34	344	...	16	1,108	...	27	...	78	46	1,765
French African Colonies and Madagascar...	...	...	...	...	...	...	14	...	...	...	...	...	14
China and Siam	761	1,951	433	732	57	452	2,359	60	62	18	100	268	7 253
Japan and Korea	600	254	...	...	23	138	2,728	1,389	1,567	41	52	162	6,954
India	2,122	7,206	4,959	3,407	105	1,863	31,242	2,139	4,481	67	491	1,734	59,816
Ceylon	179	394	112	114	...	...	1,792	36	16	...	27	1,283	3,953
Straits Settlements, Fed. Malay States and Sarawak	176	891	444	260	...	94	309	665	24	...	144	741	3,748
Hong Kong	235	3,808	355	10	...	35	993	55	...	29	34	...	5,554
West Australia	162	1,410	175	722	...	150	883	108	217	51	7	...	3,885
South Australia	285	450	176	...	490	...	638	...	199	...	174	44	2,456
Victoria	3,315	9,923	1,545	2,242	...	1,946	10,820	42	561	242	330	859	31,825
New South Wales	1,455	9,419	1,286	2,855	85	946	4,137	1,423	465	390	3,286	2,776	28,523
Queensland	91	748	17	547	11	55	667	1,400	440	44	1,716	...	5,736
Tasmania	6	32	145	107	...	...	258	13	...	325	...	...	886
New Zealand and Fiji Islands	1,608	3,227	2,524	1,442	556	876	3,069	324	453	12	11,754	17	25,862
Total, £	20,969	85,393	17,569	17,455	2,313	12,858	128,131	33,775	16,630	1,949	33,098	36,095	406,132

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	135	...	...	375	274	...	3,326	...	15	479	9,722	14,326
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	3,685	117	12,536	647	...	344	...	468	...	...	17,797
Belgium	...	...	...	...	...	...	...	...	...	...	10	10
France	350	71	10	1,484	472	484	168	18	3,417	2,989	92	9,555
Switzerland	1,249	994	218	956	220	2,722	443	...	...	910	1,070	8,782
Italy	105	2,874	...	...	...	...	1,342	...	35	17	...	4 373
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	4,601	2,412	1,775	1,366	3,523	426	8,618	47,835	3,197	8,163	5,463	87,379
Total, £	6,440	10,036	2,120	16,717	5,136	3,632	14,241	47,853	7,132	12,558	16,357	142,222

Additional imports.—Spain, electrical goods, £12; fittings, £43; carbons, £1,680; telephone and telegraph material, £10; Canada, electrical goods, £145; wires, £300; glow lamps, £4; machinery, £16; telegraph and telephone material, £1,849.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	1,351	407	...	4,128	284	95	12,147	...	100	418	1,192	20,122

Total Exports: £406,132 Total Re-Exports: £20,122 Total Imports: £146,281

Note.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

DECIMAL COINAGE AND THE METRIC SYSTEM.

(*Concluded from page* 646.)

The idea that the adoption of the metric system can be arrived at by a process of evolution, as suggested by Mr. W. Sisson, is, we regret to say, impracticable. One or the other system must be the prevailing one, and to prolong the period of thinking and working on a dual system would be highly detrimental to efficiency.

While, as we have mentioned, there is no need to alter the established dimensions of machines, such as lathes, dynamos, engines, etc., the case is different with regard to manufactured materials such as bar iron, girders, etc. Existing sizes could certainly be used for a time, redimensioned in millimetres, but as the new system came into general use, in all new work round figures would be employed, and instead of 1-inch diam. steel rod, for instance, 25-mm. rod would be called for. Here again the necessity of avoiding the prolongation of the period during which double stocks have to be carried is obvious.

We may mention that it is a known fact, proved to demonstration, that large orders for bridge-work, pipes, etc., have been diverted from this country solely on account of the inability of our manufacturers to supply them to the metric measures specified.

Perhaps one of the most serious obstacles to the general introduction of the metric system would be found in the necessity of replacing all the standard weights of retail traders. Their balances would not be affected, but a new set of weights would cost from 16s. to £2, say 30s. on the average. A Government grant might facilitate the conversion.

It is impossible in the retail trades to introduce the metric system except at one stroke; to keep two sets of weights on the counter is out of the question.

As regards the textile industries, formerly regarded as inveterate opponents to the metric system, in 1913 the Bradford Textile Society and other associations passed resolutions advocating the compulsory adoption of the metric system.

Attempts have often been made to decimalise our existing system, and an association was formed for the purpose of promoting this object. All such attempts are doomed to failure, for they would lead to endless confusion. To decimalise the inch would still leave all the disadvantages of the foot and yard. The Armstrong works have used the decimal divisions of the inch for years, and rightly, as they thus get rid of thirty-seconds and sixty-fourths. But to alter the inch, even slightly, would be fatal; the new unit would be too nearly like the old, and endless confusion would result. Germany actually attempted to do this very thing, but gave it up after inquiry, and adopted the metric system. There was no friction due to its adoption, nor was there any in Austria. In fact, wherever the system has been introduced, objections have quickly died away, and no country which has adopted the metric system—since the early struggles of France—has ever given it up. Germany finds no difficulty in manufacturing with these units; if she did, we should find her competition less effective than it is.

Many of the advantages that would ensue from the adoption of a decimal system of coinage are identical with those mentioned in connection with metric computations, such as the absence of troublesome reductions, the simplicity of addition of columns of figures, and the abolition of compound arithmetic. Decimal coinage can be handled with the slide rule, a powerful argument in its favour, and interest calculations lose all their terrors. A long time ago a first step was made towards decimalising our coinage by the introduction of the florin, which was marked "one-tenth of one pound." By increasing the number of farthings in £1 from 960 to 1,000, the thing is done. We then have the florin equal to 100 farthings, or mils, the shilling equal to 50, sixpence equal to 25, and so on. Accounts would be kept in pounds and mils, or in florins and mils, precisely as in dealing with dollars and cents, or francs and centimes. The saving in time and labour would be enormous, and foreigners would have no difficulty with our coinage, neither should we be "at sea" in foreign lands.

In 1824 the question of adopting decimal coinage in this country was broached in the House of Commons, and the "pound and mil" scheme was recommended. In 1841 the Commissioners for the Restoration of the Standards of Weights and Measures that were destroyed in the fire at the Houses of Parliament reported most strongly in favour of decimal coinage, as well as of the decimal scale in weights and measures, and their successors in 1843 repeated the recommendation, which they renewed in 1853. A Select Committee was then appointed and reported to exactly the same effect. In 1855 the subject was again raised, and in 1856 the City of London presented a petition to the House of Commons for the introduction of decimal coinage; in the same year a Royal Commission was appointed, and three years later it reported against changing the coinage while the weights and measures remained unreformed. In 1862 a Select Committee recommended the adoption of the metric system, in order to facilitate both our internal and our external trade. Many other reports on the subject were drawn up, and in 1892 the Conference of the Chambers of Commerce of the Empire passed a resolution declaring that the introduction of the decimal system of weights and measures and money was urgently needed in order to facilitate commerce. In 1893 the Trade Union Congress advocated the system, and in 1895 a Select Committee of the House of Commons was appointed, which reported that the metric system should be at once legalised for all purposes (this was done in 1897), and that after a lapse of two years the system should be made compulsory. In 1900 and 1903 the Congress of Chambers of Commerce of the British Empire again called for the adoption of the metric system, to be made compulsory after two years. In 1902 sixty municipalities petitioned the Board of Trade in favour of the compulsory adoption of the metric system throughout the Empire, and 292 members of Parliament expressed their approval of the proposal. In the same year (and also in 1903 and 1904) the Associated Chambers of Commerce declared that the adoption of the metric system was imperatively necessary in the interests of our foreign trade, and the Association of Trade Protection Societies resolved that the time had come for the compulsory adoption of decimal coinage and the metric system. In the following year the Council of the Institute of Chartered Accountants passed a similar resolution. In 1904 the second reading of a Bill for rendering compulsory the use of the metric system was carried unanimously in the House of Lords, the General Medical Council unanimously resolved that it was desirable that the metric system should be the only legal system for the dispensing of drugs, and the Chambers of Commerce of Australia resolved that the British Government be urged to recognise the necessity of adopting the metric system. In 1907 a metric system Bill was rejected in the House of Commons by a majority of 32, but in 1910 a resolution in favour of compulsory adoption passed the Australian House of Representatives by 35 votes to 2. In 1912 once again the Chambers of Commerce of the British Empire unanimously passed a resolution emphasising the growing necessity of uniform systems of weights, measures, and currency, and recommending that the question be brought before the Imperial Trade Commission which was then about to sit. At the Imperial Conference held in London in 1902, the Colonial Premiers passed a reso-

lution urging the adoption of the metric system throughout the Empire.

The metric system was made compulsory in France on January 1st, 1840. In Germany a law passed in August, 1868, made the use of metric units optional from January 1st, 1870, and compulsory from January 1st, 1872; previously a Commission had investigated the question with a view to creating a national system, but found it preferable to have an international system, and concluded that the only possible international system was the metric system. Thus Germany, at the close of a great war, and with the most diverse systems of coinage in vogue in many different States, in the course of four years carried through the whole change of coinage, weights and measures; the change coincided with the commencement of that successful industrial career which has provided her with the resources with which to make a determined bid for the empire of the world. We cannot doubt that her industrial and commercial development was intimately connected with the reform of her systems of measurement. It is interesting to observe that, in spite of the fact that the metric system was of French origin, even at that date the Germans found it preferable to adopt it rather than to range themselves in line with the British, as they had thought of doing—when they investigated our "system," naturally they were horrified.

In 1895, as a member of a deputation to Mr. Balfour, the then Prime Minister, Mr. T. Richardson, M.P., President of the North-East Coast Institute of Engineers and Shipbuilders, said that the shipbuilding and engineering interests of the North-East of England were unanimously in favour of adopting the metric system. They were willing to bear the expense of the change; in the case of his own works, where the wages bill was £2,500 a week, the cost would be a little over £100. Captain Sankey, giving evidence on behalf of Messrs. Willans & Robinson, stated that the men were not only satisfied but pleased, and had no difficulty in working to metric measures after the first few days. The Association of Inspectors of Weights and Measures expressed a strong opinion in favour of the compulsory adoption of the metric system.

It may be interesting to mention that the Decimal Association, of Finsbury Court, Finsbury Pavement, E.C., reports that never in the history of the Association "has there been so much public interest displayed in the metric system as there has been since the outbreak of the war, mainly arising from the conviction of merchants and manufacturers that we are on the threshold of a still greater era for British trade, and that we should be prepared to enter upon it with up-to-date methods."

"Much correspondence has appeared in various organs, debating the question, and canvassing from various points of view its probable effect, but the trend of opinion is that if decimal coinage were adopted in this country its advantages would be so obvious that as soon as the general public became accustomed to it, they would clamour for the adoption of a decimal system for weights and measures. This being the case, the Association has resolved to give precedence to the question of coinage, whilst at the same time in no way slackening its efforts to bring about the desired change in our system of weights and measures."

At the annual meeting of the Association of Chambers of Commerce of the United Kingdom, on March 17th, 1915, the following resolution: "That the general and immediate adoption of the metric system would be a valuable means of assisting British firms in their competition—especially with Germany and Austria—in countries where that system is in vogue, and that the Association be urged to renew its representations to the Government, and especially to the Board of Education with that object," was carried unanimously.

The metric carat came into force on April 1st, 1914; this was the first time that any part of the metric system of weights and measures had been brought into compulsory use in this country. The new carat has been a great success, the whole trade has adopted it, and people are quite used to it and are pleased with the simplification it affords in calculations; it has also had a beneficial effect upon trade.

From May 1st, 1914, recording of the barometer in inches was discarded, and in substitution therefor an absolute unit of pressure founded on the centimetre-gramme-second system was officially adopted; rainfall measurement is now given in millimetres.

In the new "British Pharmacopœia" all weights and measures are given in the metric system, "in the expectation that in the near future the system will be generally adopted by British prescribers."

His Majesty's Legation at Buenos Aires reported recently that complaints were constantly received about the attitude of the United Kingdom manufacturers in refusing to adopt the metric system in their exports to Argentina, and at a meeting of the Committee of the British Society in the Argentine Republic, held on January 11th at Buenos Aires, after a long discussion regarding the best methods to be adopted by British manufacturers to secure an extension of trade in those markets, it was unanimously decided that the most expeditious way to capture German trade in Latin America would be the adoption by Great Britain of the decimal and metric systems.

The importance of immediately adopting the metric system of weights and measures is being strongly pressed home on the United States of America by their consuls abroad.

China, by a new Weights and Measures Act, has instituted a system of weights and measures that is based entirely on the metric system.

Finally, many sympathisers, hitherto unknown to the Decimal Association, have written urging that the present time (when there is such a universal upheaval) is a golden opportunity for changing our monetary system and our weights and measures to a more rational form.

The last paragraph contains precisely the reason which has led us to advocate at so great length the early adoption of these reforms. In face of an earth-shaking catastrophe, in the presence of governmental restrictions, requirements, and regulations such as no citizen of our Empire had ever contemplated or imagined, but which everyone has readily submitted to and endured for the sake of the nation's welfare, and in view of the extraordinary rise in prices which has upset all our established conceptions of value, there could not possibly be a more favourable opportunity for consummating a reform which is widely regarded as inevitable, and which is known by the whole commercial community to be of the utmost importance to our future prosperity. In the newborn German Empire the new system was adopted during and immediately after the close of a great war, not by caprice, but as part of the considered policy of the nation, which has since contributed in no small measure to its commercial success. A people which has gracefully accepted a rise in prices amounting to about 30 per cent. without complaint will not quarrel with a change which, at the cost of a decrease of 4 per cent. in the value of the *copper coinage alone* (for the gold and silver money will not be changed) will bring so great benefits; and for the same reason no better time could be chosen than that immediately following the restoration of peace for adopting metric weights and measures; the prices of commodities will then be falling, and the slight relative loss on the copper coinage will be far more than compensated for by the real increase in its purchasing power due to this circumstance.

It is not absolutely necessary that both coinage and weights and measures should be simultaneously changed; the coinage should come first, and the rest should follow either separately or *en bloc* as might be thought advisable—subject to the proviso, we suggest, that the whole conversion should be completed within a period of twelve months from the beginning, after twelve months' warning. It is absurd to suggest that our people are less intelligent than those of the many nations that have already adopted the international system; and our native conservatism has received the greatest shock recorded in its history. Now, therefore, is the time! We earnestly urge our readers to join with us, and, by writing to their favourite papers, technical and lay; by pressing the matter on the attention of their Parliamentary and municipal representatives, and by utilising every opportunity of making converts and enlightening those who are ignorant of the advantages of reform, to create a mass of public opinion which shall prevail against the inertia of a Government which never acts until it is compelled to act. There is no time to be lost—immediate action is essential.

THE PRODUCTION AND PROPERTIES OF ELECTROLYTIC COPPER.

By B. WELBOURN.

(*Abstract of Chairman's Address, delivered to the* Manchester Local Section of the Institution of Electrical Engineers, *November 16th*, 1915.)

(*Concluded from page* 649.)

Elasticity of Copper.—In view of the extensive and increasing use of copper conductors on overhead lines, railways and tramways, and the great importance of the elastic properties of the wire in relieving strains, it seems desirable that any definition of hard-drawn wire should also include a reference to its "limit of proportionality" (elastic limit), as do many foreign specifications, and also, at first sight, to its modulus of elasticity. There are, however, practical difficulties in making these delicate measurements in works routine, and further reference will be made to these points.

The ratio of elastic limit-breaking strength, *i.e.*, the limit of proportionality, varies from about 50 per cent. for wires of 0·08 in. diameter to about 70 per cent. for wires of 0·5 in. diameter when measured on 10-in. samples. The Engineering Standards Committee might stipulate for a minimum limit of proportionality for all hard-drawn wires and state the conditions under which the test should be carried out.

These should include—

1. A statement as to the temperature, although the percentage extension does not appear to be affected by variations within the atmospheric limits in the United Kingdom.

2. The type of apparatus and the conditions under which it should be used.

3. A statement of the length of the test piece.

An excellent basis for the above is to be found in the Engineering Standards Committee's Report No. 55, which contains the results of an investigation carried out by the National Physical Laboratory on some of the standard sizes of wires used by the British Post Office.

I would suggest that this Institution (through the Research Committee) would confer a great boon on the electrical industry if it would carry through an investigation on similar lines for all standard circular wires from No. 5 S.W.G. (0·212 in. diameter) to 7/0 S.W.G. (0·500 in. diameter).

The values could then be interpolated for all other sizes of wire by using a large scale curve which embodied the results of the two investigations.

I would also suggest that the investigation should include work on stranded conductors. From the small amount of work which I have done on this point, there seems reason to believe that the limit of proportionality is higher for a given section of stranded conductor than it is for the corresponding section of solid conductor.

On all strands containing more than three wires a considerable number of tests show that the effective strength should be taken as 10 per cent. below that of the same number of straight wires. This appears to be due to the difficulty of getting the strain evenly distributed among the wires of a strand by any form of grip, and to the fact that the layers of wires are of unequal length, especially in the case of a large strand.

In the United Kingdom the regulations of the Board of Trade provide that the conductor shall be erected with such a minimum sag that at 22° F., and with a wind pressure of 25 lb. per sq. ft. of effective area, the stress in it (*excluding its elasticity*) shall not be more than one-fifth of the breaking load, and that an accumulation of snow may be ignored. The rule has the virtue of being simple, and on the safe side for English conditions, but it results in abnormal and unnecessary dips on small wires, of which No. 11½ S.W.G. is the smallest allowed.

It may be suggested for consideration that the proper procedure would be to decide what would be the worst conditions under which a conductor would have to work, and then to erect it so that, under those conditions, it would not be stressed beyond its limit of proportionality. For instance, the engineers of some of the most important Canadian power transmission lines have decided, after long experience, that, for the ordinary sizes of conductors used, the worst conditions may be taken as ½ in. thick of sleet collected on the wire at 32° F. and a wind pressure of 11 lb. per sq. ft. of effective area, and that under these conditions a factor of safety of 2 is required, and this is within the limit of proportionality.

But, whether the sag under the worst conditions is calculated one way or another, the fact remains that the elasticity of the wire ought to be taken into consideration in arriving at the correct sag to be given when the wire is erected, so that, under the worst conditions, the sag will not be greater than that calculated. The wire cannot possibly be erected under the assumed worst conditions, and it has to be sagged on comparatively still days at temperatures of, say, 50° to 70° F.

Suppose a wire has been erected with the requisite sag under the worst conditions, then when the wind drops the wire is relieved of a certain amount of stress and it contracts by an amount depending upon the stress it has been relieved of and the modulus of elasticity, but in the very act of contracting it diminishes the sag, and this again puts a greater stress on the wire and tends to stretch it back to its original position; consequently, the actual sag taken up by the wire is a matter of somewhat intricate calculation.

Again, suppose a wire is hanging with a certain sag at a certain temperature and the temperature rises, say 20° F., the length of wire in the span will increase by an amount depending on the coefficient of expansion of the metal. This lengthening would increase the sag, but increasing the sag reduces the tension in the wire, and again the wire by reason of its elasticity will contract by a certain amount depending on the stress it has been relieved of by the lengthening of the wire and the modulus of elasticity.

It is rather a long and wearisome matter to calculate from the worst sag under windage and low temperature what the erecting sag will be at, say, 60° F. with no wind, but the following formulæ will be found both useful and accurate, and they afford a ready means of obtaining the result. It may be said that the most convenient way to use the second formula is by assuming values of d_2 and plotting a curve from the values of t_2 so obtained, from which curve can be read the sag at any required temperature.

d = sag in feet under the worst conditions as calculated from the usual formula $d = l^2 w/8 s$, where—

l = span length in feet.
w = resultant of weight and wind pressure in lb. (per foot).
s = tension in conductor in lb.
d_1 = corresponding sag at same temperature when wind and ice are removed.
w_1 = weight per foot of wire only.
M = modulus of elasticity (say, 18,000,000).
A = cross-section of wire in sq. in.

Then to find d_1 use the formula:— $\frac{w_1}{d_1} - \frac{w}{d} = \frac{64 (d_1^2 - d^2) M A}{3 l^4}$.

From d_1 it is possible to find the sag d_2 at any other temperature from the formula:—

$$t_2 - t_1 = \frac{8 (d_2^2 - d_1^2)}{(3 l^2 + 8 d_1^2) c} + \frac{s}{M A c}\left(1 - \frac{d_1}{d_2}\right)$$

t_1 = temperature in ° F., with sag d_1.
t_2 = any other temperature in ° F.
d_2 = sag at temperature t_2.
c = coefficient of expansion per ° F.

An examination of the stress-strain curve of any hard-drawn copper wire will show that the modulus must be constant for the particular size, since the curve is a straight line up to the elastic limit, but the modulus is not necessarily the same for different sizes of wire.

In making measurements for true modulus values, it is, in my opinion, necessary to work on long lengths of wire which approximate to the span length employed on a tramway or other overhead line. I have been led to this conclusion by a study of the results recorded by the National Physical Laboratory in the Engineering Standards Committee's Report No. 55 on lengths of wire up to 50 ft., and of the method described by Mr. W. B. Woodhouse before this Institution, in the paper already referred to. His tests were made with No. 6 S.W.G. wire on a span of 110 ft., and, assuming the correctness of his measurements, it may be deduced from them that the modulus varied from 18,700,000 to 20,700,000, and gave an average value of 20,000,000. The method and the long length of the test piece would tend to eliminate sources of error.

The moduli given in the Engineering Standards Committee's Report No. 55, Table No. 10 vary between 17,200,000 and 18,200,000 on the second and third applications of the load, and particular attention is drawn to the different values of the readings on the first and subsequent applications of the test load. On the first application of the load, the kinks in a coil of wire were pulled straight, and the "apparent moduli" varied from 12,300,000 to 15,300,000, while on the subsequent loadings the values were as stated, viz, 17,200,000 to 18,200,000.

In the report referred to, the following statement is made:—

"It is thought, however, that the values of the 'apparent moduli' will be of interest and use, since it is these which must be taken into account in the erection of long lengths of wire."

I venture, with all respect, to express strong disagreement with this statement, because on all well-constructed overhead lines the wires should first be strained to a tension higher than that at which they will be permanently bound in. The object of this is to get rid of the kinks referred to in the report, and to allow the wires, especially stranded conductors, to "settle down." This procedure makes it permissible to take advantage of the real modulus value.

In view of the figures and considerations quoted, I consider that it is permissible to adopt an all-round value of 18,000,000 in future, instead of the usual text-book figure of 16,000,000.

I am afraid, however, that it will not be practicable to embody a *minimum* modulus value in ordinary specifications of hard-drawn copper, in view of the difficulties and delays which would occur in most works in carrying out the sensitive tests required. In special cases, however, it might be advisable to specify a minimum value and to make arrangements with the National Physical Laboratory or other testing institutions to provide the necessary apparatus and carry out the tests on specimens provided for the purpose.

Tensile Strength.—An interesting point arises out of the widely-held belief that the strength of hard-drawn wire lies in its skin being hardened during the drawing process. An examination of the matter does not disclose any conclusive evidence in support of this theory. I have investigated the matter and obtained the following results, starting with a length of .400 in. diameter hard-drawn circular trolley wire. Six pieces were turned down to different diameters with great care, in order to avoid undue heating of the specimens.

Test No.	Dia. ins.	Area sq. in.	Breaking load.	Breaking stress, tons per sq. in.	Percentage elongation on 10 in.
			lb.		
1. Original wire...	·400	·1257	6,950	24·70	2·50
2. Turned down...	·376	·1110	6,190	24·85	—
3. Do.	·351	·0967	5,520	25·42	—
4. Do.	·326	·0834	4,745	25·40	—
5. Do.	·301	·0711	4,100	25·70	—
6. Do.	·276	·0598	3,425	25·60	1·66
7. Do.	·250	·0491	2,840	25·80	

This result is not, of course, absolutely conclusive because the work done on the wire in the lathe will have some effect in hardening the skin at each stage.

The question whether the strength of copper wire is uniform throughout its cross-section is of great importance in connection with the contact wires on railways and with trolley wires on tramways, because they are subject to wear from pantographs, slider bars and trolley wheels. An investigation was made on this point recently on a 0·25 sq. in. grooved contact wire in connection with a railway electrification scheme which is now under construction. The wear on the wire was reproduced by gently filing away the face, and the cross-sectional area was accurately determined by weighing the specimens. The results are shown on fig. 1. The tensile strength of the original section of this wire was 21·8 tons per sq. in., and the extension was 6 per cent. on a 10-in. piece. It also withstood the following severe torsion tests without showing any signs of fracture: the wire was given 3½ complete twists in a length of 8 in.

Test.	Amount filed off working face.	Cross-sectional area, sq. in.	Maximum load, lb.	Maximum stress, tons per sq. in.	Yield load.	Yield stress, tons per sq. in.	Limit of proportionality.
A	Original wire	·246	12,150	22·0	9,500	17·2	78 %
B	·030	·234	11,900	22·6	9,500	18·1	79 %
C	·060	·226	11,650	23·0	9,500	18·7	81 %
D	·090	·221	10,900	22·0	9,500	19·2	87 %
E	·120	·207	10,300	22·2	9,000	19·4	87 %
F	·150	·195	9,600	22·0	8,500	19·5	88 %

Effect of Temperature.—The current which any bare overhead conductor will carry for a specified temperature rise under still air conditions can be predetermined by the use of Prof. George Forbes's formula:—

$I^2 = D^3 t \pi^2 H/(4 R \times 0{\cdot}24)$ where—

I = Current in amperes.
D = Diameter of solid wire in cm.
t = Temperature rise in °C.
H = Coefficient of radiation (0·0003 for solid wire or 0·00344 for stranded conductors).
R = Specific resistance of copper per cb. cm. at limiting temperature.
·24 = Calories in a joule.

$d \pi^2 H/(4 R \times 0{\cdot}24)$ = 44,250 for a limiting temp. of 125° F. (for solid wire).
= 50,750 " " (for stranded wire)
= 80,840 for a limiting temp. of 175° F. (for solid wire).
= 92,300 " " (for stranded wire).

The question of the maximum permissible temperature of hard-drawn copper is of importance on overhead power lines because of the effect of heat in reducing its tensile strength.

The National Physical Laboratory found that on wires up to ·194 in. diameter "the reduction in breaking load due to temperature appears to be approximately one-tenth of 1 per cent. of the breaking load at normal temperature per degree Centigrade rise of temperature."

I have carried out a series of tests on specimens of 4/0s. copper trolley wire, diameter 0·400", using apparatus which did not admit of any such refinements as those at the disposal of the National

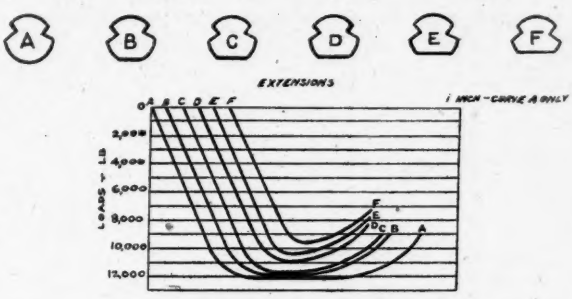


FIG. 1.—AUTOGRAPHIC RECORD OF TENSILE TESTS ON H.D. COPPER TROLLEY WIRE (GROOVED SECTION).

Physical Laboratory, and have obtained results which, so far as they go, seem to confirm that the National Physical Laboratory's determination, quoted above, will hold good for all sizes of circular copper wire.

A number of experiments have been carried out by Dr. F. J. Brislee to determine the permanent effects of prolonged heating on the strength of wire, and he has very kindly given me the results of experiments on trolley wires.

From these results it appears that with 1/0 S.W.G. trolley wire, the permanent decrease in strength after two hours' heating at 150° C. (302° F.) is only 0·5 per cent., while a 4/0 S.W.G. wire was not affected after four hours.

Among tramway engineers it is generally understood that the temperature of trolley wires never exceeds 220° F. (say, 105° C.), and it is a fair deduction from the above tests that the limiting temperature is not reached. In view, however, of the fact that the temperature rise occurs on wires while under strain, it would not appear to be advisable to exceed a temperature of 250° F. in practice. At this temperature the tensile strength of the wire would be about 10 per cent. less than at normal temperature, but the strain would be relieved by the expansion due to heating.

In this connection, it may be noted that the Engineering Standards Committee's Report No. 55 gives the coefficient of expansion of copper per 1° C. as varying between 0·0000163 and 0·0000167. The average of these is equal to 0·0000093 per 1° F. The voltage drop due to resistance would appear to be the limiting feature in overhead wires, rather than the question of temperature. In case it should be necessary to know the resistance of copper resulting from change of temperature, this formula may be used:—

$$R t = R o (1 + 0{\cdot}0042 t),$$

Where $R o$ = the resistance at o° C.
$R t$ do. at t° C.

RUSSIAN ELECTRICITY WORKS STATISTICS.

THE statistical statement of central electrical stations in Russia for the year 1913 appears in the *Elektrichestvo*, No. 11, July issue, which has been late in appearing, due, no doubt, to the war situation, but partly, it is explained, to the installation of electrical driving plant in the printing office.

The statement is of considerable extent, and the most interesting features are reproduced in the accompanying table. It may be stated, by way of explanation, that the populations of the communities served vary between 3,000 (Balaclava) and 2,073,800 (Petrograd). Further, 54 of the 80 stations of which particulars are given supply direct current, 22 supply alternating current, and four supply both. Respecting the motive power, it appears that 47 have steam power, 16 gas, 16 steam and gas, and only one has water power—that of Suchum Kale; 59 of the stations, again, are specifically designed for lighting and power, 10 for tramways, and 11 for lighting, power, and tramways. The period during which exploitation has been exercised varies from one year, as in the cases of Grodno and Elabug, to 24 years in the case of Kieff.

The favourite type of oil engine appears to be the Diesel, and the storage battery usually employed is the Tudor. The Suchum-

RUSSIAN ELECTRICITY WORKS.

Place.	Supply authority.	Year of opening.	Supply pressure, volts.	Frequency and phase.	Total capacity of plant in kw.	Total connections in kw.	Units sold for all purposes, per annum.
Alexandrovsk	Town Council.	1910	2 × 220	Direct.	373	712	413,302
Baku, White Town } Bibi Eybat }	Electric Power Co.	1900	1,000 and 2,000	3-phase.	29,000 3,000	57,904 10,682	73 081,333 15,539,102
Warsaw (Tramways) ...	Warsaw Magistracy.	1908	6,000	Direct.	4,000	8,832	8,559,390
Grodno	Town Council.	1912	2 × 220	Direct.	183	558	193,540
Elabug	Town Council.	1913	110	1-phase.	88	78	69,638
Kazan	Belgian Co.	1896	2 × 150	Direct.	1,372	2,548	1,466,363
Melitopol	Town Council.	1901	250 and 500	Direct.	300	—	344,587
Mohilieff, Podolia Govt.	Electric Light Co.	1912	—	Direct.	200	217	108 242
Moscow (Tramways) ...	Town Council.	1907	600	25 ~ 3-ph. and direct.	23,877	57,510	56,380,032
Nachichevan-on-Don ...	Town Council.	1910	2 × 220 (500 st. lg.)	Direct.	479	1,055	713,600
Odessa	Odessa Electrical Co.	1910	—	50 ~ 3-phase.	7,500	7,292	4,634,407
Orenburg	Town Council.	1898	120	1-phase.	616	592	483,033
Penza	Y. Milman and Ph. Titoff.	1907	220	Direct.	90	—	—
Pernau	Town.	1907	2 × 220	Direct.	260	496	221,375
Petrograd (Tramways)	Town Council.	1907	600	3-phase.	7,500	22,844	34,872,337
"	Petrograd Town Electric Lighting Co. (Belgian Co.)	1898	110	42·5 ~ 1-phase	18,460	32,058	—
"	1886 Co., Electric Lighting.	1898	120	—	25,000	57,562	53,430,850
Pskoff	Town.	1907	2 × 250	Direct.	1,190	1,158	899.009
Riga	Town.	1904	120	3-phase.	7,060	13,271	6,371,625
Rostoff (Jaroslav) ...	Town Council.	1905	2 × 220, 2 × 250	Direct.	275	627	529,895
Rybinsk	Town Council.	1907	2 × 220	Direct.	512	835	480,822
Stavropol (Caucasus) ...	Town.	1909	250	Direct.	135	692	297,540
Suchum Kale	Suchum Electrical Co.	1909	125 (500 st. lg.)	3-ph and direct.	435	452	431,222
Armavir	Armavir Electrical Power Co.	1905	220	Direct.	350	720	422,907
Balaclava	Town Council.	1911	—	—	49	44	26,000
Batoum...	Town Council.	1900	2 × 250	—	195	188	224,290
Bisk	Electric Light Co.	1900	—	1-phase.	154	—	62 500
Warsaw (Lighting) ...	Warsaw Electric Co.	1903	125	50 ~ 3-phase.	11,590	—	11,199,350
Vilna	Town Council.	1903	2 × 220	Direct.	1,025	—	1,547,362
Vladivostok	Town Council.	1912	220 lg. and pr.; 550 tr.	3-ph. & direct.	1,350	1,509	1,080,614
Vologda	Town Council.	1904	220	Direct.	118	93	149,361
Voronezh	Russian Siemens & Halske Elec. Works.	1899	—	1-phase.	825	1,123	933,235
Ekaterinodar (Lighting)	Town Council.	1906	—	—	820	1,144	1,128,060
" (Tramways)	Belgian Tramways & Electricity Co.	1900	500	Direct.	1,150	3 583	2,367,743
Ekaterinoslaff (Lighting and Power)	Central Electric Co.	1902	525	Direct.	3,990	6,528	5,894,000
" (Tramways)	Ekaterinoslaff Tramways Co.	1897	—	Direct.	1,185	—	1,995,000
Zhitomir	Russian Town & Roads Co.	1899	2 × 230 lg. and pr.; 550 tr.	Direct.	750	1,156	950,241
Irkutsk...	Town Council.	1910	115 (& 275 arc lg.)	1-phase.	847	1,765	1,012,693
Kovno	Kovno Electric Light Co.	1900	2 × 110	Direct.	742	1,001	608,508
Kieff	Kieff Town Tramways Co.	1890	600	Direct.	4,220	14 043	13,378 971
Libau	Continental Traction & Elec. Lighting Co.	1899	2 × 220 lg.; 500 tr.	Direct.	1,903	3,715	2,133,788
Lodz (Lighting) ...	1886 Co., Lodz Branch.	1908	120	50 ~ 3-phase.	15,000	26,011	31.701,417
" (Tramways) ...	Lodz Electric Tramways Co.	1898	—	—	1,750	—	3 994,300
Moscow (Lighting) ...	1886 Electric Lighting Co.	1897	120	3-phase.	35,000	71,149	53,002 360
Novgorod, Sieversk ...	Town Mutual Insurance Co.	1901	500	Direct.	90	—	56,000
Novocherkask	Town Council.	1900	2 × 110	Direct.	670	896	588,689
Pavlovsk	Pavloff Electric Co.	1911	2 × 240	Direct.	174	162	103,075
Petrograd	Petrograd Electrical Works Co.	1897	3,000	—	12,320	—	22 903,666
Poltava...	Town.	1900	2 × 125 D.C.; 190 and 110 A.C.	3-ph. & direct.	416	658	411,013
Poti	Town.	1906	480	—	106	63	186,400
Rostoff-on-Don (Light)	N. V. Smirnoff.	1909	2,000	50 ~ 3-phase.	2,600	2,376	—
" (Tramways)	Belgian Rostoff-on-Don Elec. Trmwys. Co.	1901	550	—	2,100	4,000	3,041,000
Smolensk	Smolensk Electric Co.	1901	2 × 220; 550 tr.	Direct.	500	1,573	1,032,148
Tver	Tver Electric Tramways & Lighting Co.	1901	110 D.C.	3-ph. & direct.	135	1,319	605,294
Tomsk	Tomsk Electric Lighting Co.	1895	110	1-phase.	1,058	—	700,000
Chavarovsk	Electric Power Co.	1906	2 × 220	Direct.	389	767	496,700
Karkoff...	Town.	1896	125 & 250 lg. and pr.; 600 tr.	Direct.	2,490	8,674	4,991,952
Cherson	Town.	1908	2 × 275	Direct.	487	1,125	718,773
Tzechotzinsk	Tzechotzinsk Government Water Cure Establishment.	1902	—	Direct.	84	—	26,240
Chernigoff	Town.	1893	2 × 220	Direct.	573	542	260,499
Yalta	Town.	1904	2 × 220	Direct.	515	880	466 000
Elizabetgrad	Town.	1908	2 × 220	Direct.	387	—	689 294
Minsk	Town.	1904	—	—	300	—	638,781
Nikolaieff	Town.	1902	2 × 220	Direct.	804	—	1.888,967
Jaroslav	Town.	1900	2 × 230	—	1,420	2,189	(1,510,000)
Bielostok	Electrical Enterprises Co., Berlin.	1910	—	—	830	1,114	697,362
Vladimir	K. A. Russkoff.	1908	2 × 220	—	168	—	106,330
Viatka	Town.	1903	2 × 220	Direct.	440	965	553,852
Kishineff	Town.	1909	2 × 220	Direct.	532	671	423,000
Nikolsk Ussurisk ...	Ussurisk Electric Co.	1908	—	Direct.	193	302	231,000
Upha	N. V. Konshin.	1898	2 × 220	Direct.	635	607	430 860
Chita	N. P. Polyakoff Co.	1906	2 × 250	Direct.	285	500	36,000
Astrachan (Tramways)	Private.	—	—	Direct.	500	—	1,424 550
Berdiansk	Town.	—	2 × 220 (540 st. lg.)	Direct.	110	125	134,869
Kieff (Lighting) ...	Private.	—	3 × 190 A.C.; 2 × 110 D.C.	3-ph. & direct.	—	14,271	10,946,507
Taganrog	Private.	—	2 × 110	Direct.	—	(151)	40,000
Perm	Town.	—	2 × 220 D.C.; 110 A.C.	3-ph. & direct.	—	1,192	722,611
Radom	Private.	—	2 × 220	Direct.	—	571	404,000
Riga (Tramways) ...	Private.	—	—	—	—	—	—
Samara...	Town.	1899	—	3-ph. 2,000/120	—	372	222,445

Kale plant is driven by the water of the river Besletka; the current generated is used for lighting the streets with arc lamps.

Although the statement generally refers to the working year 1913, there are some exceptions, due, doubtless, to particulars not having been received for that year in time.

It will be understood that great modifications will be observed in statements for 1915, for many of the stations included in the statement are situated in territory now occupied by the enemy; even when the time comes to re-establish the stations, it will in all probability be found that the plant has not been removed with sufficient skill to restore it as it stood, and the probability is that where it is hoped to reinstate the stations, entirely new ones will have to be equipped.

It is also gathered from the statement that machinery or apparatus has been supplied to the various stations by Phelzer, Bergman, Siemens-Schuckert, Nobel, Siemens & Halske, A.E.G., Tudor, Volta Works, the Kolomensk Factory, the Diesel Co., the Augsburg Works, the Glieboff Works, Westinghouse, Brown-Boveri, Bromley Bros., Babcock & Wilcox, Fitzner and Hamper, the Tosi Works, Van der Kerk, the Goerlitz Engine Works, Krupp, Sulzer, Escher-Wyss, Helios, Steinmuller, Brun, Borman and Schwede, Robey & Co., Hindley, Philips, Wolf, &c.

LEGAL.

Dexter *v.* Aldershot Urban District Council.

In this case, which came before Mr. Justice Neville, in the Chancery Division, on several days last week, plaintiff, Mrs. H. M. Dexter, of Cargate House, Aldershot, claimed an injunction to restrain the Aldershot U.D.C., their servants and workmen, from working the plant and machinery at their electric light station in such a way as to cause nuisance or injury to the plaintiff.

Mr. Jenkins, K.C., and Mr. Church appeared for the plaintiff, and defendants were represented by Mr. Peterson, K.C., and Mr. Stamp.

Mr Church, in opening the case, said that the nuisance complained of was with regard to the engine house, and a water tower, respectively. The water tower discharged vapour which settled and caused considerable nuisance. Plaintiff's house was one of eight rooms and it adjoined the defendants' premises. The defendants' shed, in which a Diesel engine was running, was 155 ft. from the back of plaintiff's garden, and the condensing water tower was 66 ft. 9 in. from the plaintiff's premises. Plaintiff owned the freehold, her late husband having had the house built in 1887-8. They were away from the house from 1890 until 1909. Some of plaintiff's paying guests would give evidence. She did not make any complaint of loss of business by reason of the nuisance. Under a provisional order dated 1912 defendants put down the plant referred to. The water tower was not then in existence, and it was not until after the pleadings in the action were closed that it was erected. The writ was issued in June, 1914, and afterwards leave was obtained to amend the pleadings, so as to include the water tower. Sec. 70 of the Act under which the provisional order was granted provided that nothing in the order should exempt the undertakers from the consequences of any nuisance if they committed one. There was not any dispute about that. The simple question was nuisance or no nuisance. In their statement of defence the Council admitted that there had been some vibration from their engine, but denied that there had been enough to cause injury to the plaintiff or her house. They had done their best to cease all vibration, and hoped in time to be perfectly successful. At present they were only working from 6 a.m. until 9 30 p.m., on Saturdays, and from 6 a.m. until 8 p.m. on other days, and they were willing to undertake to restrict their working to these hours until means had been found for satisfactorily preventing any vibration. They had also paid £5 into Court to satisfy any damage the plaintiff might have suffered.

Several witnesses gave evidence as to the existence of noise and vibration. Plaintiff was called. She said that she first noticed vibration in July of 1912. She had experienced noise before that. She had been troubled by noise as early as 1911, when her husband was lying ill. When she experienced the vibration in 1913 she wrote to Mr. Garside, the manager of the works, and afterwards Mr. May, the chairman of the Council, visited her house. She pointed out to him certain cracks that had been caused by the vibration. Pointing began to drop out of the brickwork of her house about 12 months ago. It came principally out of the drawing room. It was still dropping out, some coming out as recently as two or three days ago. A joint inspection of the house took place on March 19th this year and October 25th, and between those dates a new noise made itself manifest from the defendants' works—a sort of whirling noise.

Evidence of the plaintiff's experts who attended the joint inspections was to the effect that both noise and vibration were distinctly noticeable in the house. On placing a hand on a mirror on the wall vibration could be distinctly felt. The noise from the exhaust, however, was not loud when the windows were closed. The moisture from the water tower was plainly visible, and fell in the form of a Scotch mist. The vibration ceased when the defendants' machinery was stopped. There was still noise and vibration discernible after the engines had stopped, presumably coming from the condensing plant. Mr. Dykes, who had also inspected the defendants' premises, said that he found there four Willans-Parker continuous-current machines (three 460 volts, 165 amperes, and 1,160 r.p.m., and one 460 volts, 435 amperes, and 350 r.p.m.). There was also a Carels-Diesel set (440 volts, 307 amperes, and 220 r.p.m.). All were set in substantial buildings. On the visit made in March to the plaintiff's house these engines were run at varying speeds, and though the vibration was noticeable the whole time, the difference in the running did not make any appreciable difference in the vibration. It was less, however, when the Diesel engine was not running.

At the conclusion of the Witness's evidence, Mr. Justice Neville asked whether, when the Diesel engine was stopped, and the steam engines were still running, the vibration was still noticeable.—Witness said No.

His Lordship: Then, speaking with regard to the state of things as they exist at present, the vibration is caused by the Diesel engine alone?—Witness said that he would not go so far as that, but the vibration was much less when the Diesel engine was not running.

Opening the case for the defence on November 18th, Mr. Stamp submitted that the plaintiff was not entitled to an injunction, as having regard to the character of the neighbourhood there was no such noise or vibration experienced in her house as would entitle her to relief.

His Lordship expressed the opinion that if the plaintiff was entitled to relief at all it was a case for an injunction and not for damages.

Mr. Stamp said his submission was that there was no such nuisance as would justify the action at all.

Mr. Garside, engineer to the defendant Council, said he had visited the plaintiff's house in conjunction with others. He heard nothing that would justify any complaint, nor could he detect any vibration.

Prof. Boys, who had also visited the plaintiff's house, said he went there with a number of other people present. He was unable to detect any vibration or noise, but he agreed that he might if he had been in the room by himself at night when everything was quiet, presumably have been able to detect something. He did not, however, believe that it would have disturbed him at all.

His Lordship held that upon the evidence there was an actionable nuisance, and he must grant an injunction. He would suspend its operation, however, to give the defendants an opportunity of abating the nuisance. He saw the difficulty they were in owing to the shortage of labour at the present time, and would accordingly suspend the operation of the injunction until three months after the termination of the war.

Osram Lamp Works, Ltd., *v.* Merryweather & Sons, Ltd.

A pending action in which plaintiffs claimed an indemnity was mentioned to Mr. Justice Scrutton, in the King's Bench Division, on November 18th.

Mr. Harold Brandon (for plaintiffs) stated that the defendants were installing a fire apparatus for the Osram Co., when some coal fell upon one of the plaintiffs' employés. She was seriously injured and plaintiffs had to compensate her, in respect of which they claimed an indemnity from the defendants. The girl had now named a lump sum which she would accept in full satisfaction, and the parties had arrived at a settlement. In the ordinary course, the girl being an infant, the arrangement would have to be approved by the Court, and that being done, it would be binding upon the girl. Notice to that effect would have to be given to the girl, and he, therefore, asked that the case might stand out of the list to enable it to be done.

His Lordship ordered that the action should stand out generally with liberty to the parties to apply to restore it when ready.

A Manchester Tramway Compensation Award.

At Manchester Assizes last Friday, Wm. S. Hopkinson claimed damages from the Manchester Corporation for personal injuries received in a tramcar accident. Plaintiff is 62 years of age, and a coal carter. On October 15th of last year he was proceeding along Holme Hall Lane with his horse and cart when a tramcar collided with the vehicle in the rear. Hopkinson was knocked down by the cart, and a wheel passed over his leg, with the result that the limb had to be amputated. For the defence it was alleged that there was room for the tramcar to pass the horse-drawn vehicle, but the cart was pulled into the middle of the road, and the car driver was unable under those circumstances to avoid a collision.

Mr. Justice Ridley gave an award in favour of the plaintiff for £650, and granted a stay of execution.

Munitions Case.

At the Oldham Munitions Tribunal last week, Messrs. J. P. Hall & Co., electrical engineers, of Blackridings Ironworks, Oldham, brought a complaint against Leonard Barber, an apprentice armature winder, who was alleged to have neglected to obey the lawful orders of a person having authority over him. It appeared from the statements of representatives of the firm's that Barber had to work overtime four hours every night, and on November 10th he asked permission to leave at 5.30 p.m. He did not say why he wished to leave early, and he had previously had two hours off on two nights in the same week. Permission was refused. Mr. Alfred Marland, the secretary of the firm, said that when told he could not have the time off Barber said he would go whether he was allowed or not. During the past 12 weeks Barber had averaged 59½ hours per week, which meant about five hours' overtime each week.—Barber told the chairman (Mr. W. Sellars) that he had been on overtime for about 12 months, with the exception of one fortnight. Every week they were allowed one night off overtime, and he had recently been having the Wednesday evening off. When he sought per-

mission on November 10th it was refused. He had been secretary to a Red Cross comforts organisation and had been organising a dance, and that was why he wanted the Wednesday evening off. He did not, however, tell the foreman this. He alleged that the foreman swore at him, and in return he said he would take the night off whether he received permission or no.—Mr. Sellars said he did not think it was a good excuse to ask off, even if the dance was in aid of the Red Cross.—The chairman added that he and his colleagues were satisfied there had been a breach of the rules, and they were not going to encourage insubordination in the works. They did not, however, regard this as a serious case, and considering Barber's previous good character they did not think the firm would wish for a heavy penalty.—Mr. Marland said that Barber had been warned of the consequences. All the firm wanted was to maintain discipline.—A fine of 5s. was imposed.

Osram Lamp Works, Ltd., *v.* Pope's Electric Lamp Co., Ltd.

The hearing of this case was continued in the Court of Appeal, composed of the Master of the Rolls and Lords Justice Bankes and Warrington, on Thursday last week, upon the appeal of the plaintiffs from the judgment of Mr. Justice Joyce, holding that the defendants had not infringed the plaintiffs' patent.

Mr. Terrell, K.C., on behalf of the respondents, contended that there was no invention in the selection of tungsten for lamp filaments. There was nothing new in the treatment with an organic binding material—the carbonising process was known. The patentees had made it an essential part of their process that the electric current should be passed through the filament. It was not known that the only object of passing the current through was to heat the filament, or that external heating would have the same effect. Defendants did not use the equalising process, which was an essential part of the invention. Defendants had not used any of the three points put forward by the patentees as being essential. The process of building up a filament was well known. Welsbach's process was known to be applicable to many metals, and all that the patentees did was to tell one to try it on another metal. There was no subject matter in merely taking a substance well known to be suitable for a particular purpose, though it might not have in fact been used for that purpose, and applying it to a well-known purpose. Counsel contended that the defendants did not infringe because they did not use an atmosphere of steam and hydrogen. Defendants did not infringe because they did not carbonise.

An Electrical Company Fined.

At Woolwich Police Court on 19th inst., Mr. Hay Halkett concluded a long hearing of several summonses brought by the Commissioners of Customs and Excise against the Western Electric Co., Ltd., and inflicted fines as under: For sending, on January 2nd, certain prohibited goods, viz., parcels of materials for telephones, to the North Woolwich Sub-Post office, for exportation to Norway, £15 and £12 12s. costs; for a similar offence on January 9th, £1; for a similar offence on March 15th, £1; for causing to be made a declaration that the parcel on March 15th contained no prohibited goods, this being false in that it contained rubber, £15; and for sending, on June 17th, to the Royal Albert Docks for exportation prohibited goods, viz., parts of telephone sets, £10.

Mr. G. E. Thompson, one of the company's managers at their North Woolwich works, was fined £5 for aiding and abetting in the commission of the first offence, and 10s. in respect of the second offence.

Mr. Simpson, for the prosecution, said there was no suggestion that any of the goods were intended for the enemy, but proceedings had been taken because the authorities considered that there had been gross carelessness on the part of the defendants in dealing with prohibited goods.

For the defence, it was contended that the offences had been committed through misunderstandings on the part of certain of the company's staff.—*Daily Telegraph.*

The British Electric Traction Co., Ltd.

In the Chancery Division last week, Mr. Justice Astbury had before him a petition to sanction a scheme of arrangement and to confirm a reduction of the capital from £4,000,000 to £2,998,398. The petition was opposed by certain persons who held income certificates. According to the *Financial News*, his Lordship said that the Registrar had been bombarded with reasons why the petition should be opposed. Mr. Clauson, K.C., who appeared for the income certificate objectors, raised a point which Mr. Russell, K.C., for the company, said he could not discuss then as it would necessitate going into evidence as to the reserve fund. The petition was allowed to stand over in order that that point might be met.

Tramway Companies and Lost Property.

At Edinburgh, Sheriff Guy gave his decision in a case which concerned the liability of Musselburgh Tramway Co. for a passenger's belongings which went amissing. A lady sued the company for £5 odd, representing the value of a bag containing a sum of money, &c. The bag was left on the seat of a tramcar by the lady. The conductor placed it at the end of the car in a box where he kept his spare tickets. Later he found that the bag had disappeared. The Sheriff said before the law of deposit could be held to apply to the tramway company, it would be necessary to charge them as depositaries, and if the articles had been taken to the company's offices the case might have been different. But the conductor was the depositary. There was no deposit with the defenders. In these circumstances, he found that the defenders were not liable.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

15,737. "Semi-obscured reflecting electric incandescent lamp." F. T Harris & G. W. Smith. November 8th.

15,740. "Electric overhead tram trolley." W. Cayless. November 8th.

15,759. "Cathode for electrolytic cells." F. G. Wheeler. November 8th. (Convention date, January 25th, 1915, U.S.A.) (Complete.)

15,761. "Replenishing electrolytic cells." W. S. Smith. November 8th. (Convention date, June 3rd, 1915, U.S.A.) (Complete.)

15,762. "Electrically-controlled clutches." W. Langdon-Davies and A. Soames. November 8th.

15,792. "Electric motors." F. J. Osius. November 9th.

15,810. "Control of alternating-current motors." P. S. Turner. November 9th.

15,824. "Construction of grids for secondary batteries." G. A. Smith. November 9th.

15,842. "Electrically-driven adding and listing machines, copying machines, typewriters, addressing, talking, or other like machines." J. Drucquer. November 10th.

15,863. "Pocket lamps." Dr.-Ing. Schneider & Co. Elektrizitats Ges.m.b.H. November 10th. (Convention date, December 3rd, 1914, Germany.) (Complete.)

15,873. "Sparking arrangements for electric ignition devices." H. W. F. Ireland. November 10th.

15,878. "Electric switches." British Thomson-Houston Co., Ltd. November 10th. (General Electric Co., U.S.A.)

15,883. "Electric switches or bell pushes." W. R. Bloxam. November 10th.

15,915. "High-frequency alternating-current relays for radio-telegraphy and the like." A. W. Sharman. November 11th.

15,922. "Combination electric turn switch and wall plug." C. E. Begg. November 11th. (Complete.)

15,930. "Electric cells." C. Fery. November 11th. (Complete.)

15,971. "Trolley collectors for overhead tramway, railway, and like vehicles." P. W. Steele. November 12th.

15,978. "Electro-chemical microphones, principally for use in connection with wireless telephony and telegraphy." A. F. Sykes & S. Ford. November 12th.

15,985. "Electric lamp holders for vehicle head lamps." F. E. Wilson, W. A. Shepherd, and Powell & Hanmer, Ltd. November 12th.

15,986. "Electrical connections for use in the electric lighting of automobiles." F. E. Wilson, W. A. Shepherd, and Powell & Hanmer, Ltd. November 12th.

15,989. "Construction of terminal for electric switches, couplings, and the like." G. Markt. November 12th. (Complete.)

16,017. "Combined air and electric triple valves." W. G. Canion. November 12th. (Complete.)

16,044. "Electric fly-traps." J. Satinover. November 13th. (Convention date, November 27th, 1914, U.S.A.) (Complete.)

16,053. "Automatic protective gear for electrical systems." M. Rosenbaum & F. A. Couse. November 13th.

16,057. "Venting appliance for use in connection with accumulators or secondary batteries using wet acid." A. E. Nevill. November 13th.

16,058. "Electric meters." H. O. Merriman & T. Speirs. November 13th. (Complete.)

16,060. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., & S. R. Smith. November 13th.

PUBLISHED SPECIFICATIONS.

1914.

10,048. Device for use in connection with Electric Motors directly Coupled with Pumps, Water Sirens, and the like. Signal Ges. April 23rd. (August 18th, 1913. Addition to 7,821/14.)

10,562. Double-pole Electric Rotary Converter, also applicable as a Double Current Generator or Motor. J. L. la Cour. April 29th. (Convention date not granted.)

11,837. Apparatus for Converting Direct into Alternating Currents, and vice versa. E. Falkenthal. May 13th.

16,850. Manufacture of Incandescent Electric Lamps. H. G. Finch (Lord Guernsey) and J. F. Poynter. July 15th.

20,009. Thermopiles and Thermo-electric Measuring Apparatus. H. Hausrath. September 21st.

21,143. Electrically-actuated Tools. W. J. Mellersh-Jackson (Commonwealth Electric Tool Co.). October 17th.

21,338. Telephone Systems. A. B. Smith. October 21st. (October 22nd, 1913.)

21,474. Receiving Arrangements for Wireless Telegraphy. T. W. Stratford-Andrews & A. Orling. October 24th.

21,509. Regulators for Charging Electric Secondary Batteries. E. B. Jacobson. October 26th. (December 3rd, 1913.)

21,512. Electric Starting Systems for Internal-combustion Engines for Automobiles. E. B. Jacobson & C. J. Gustafson. October 26th. (December 3rd, 1913.)

21,609. X-ray Apparatus. E. E. Greville. October 27th.

21,761. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. October 30th.

21,978. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. November 4th.

22,639. Coil-winding and similar Machines. G. P. Thompson & M-L Magneto Syndicate, Ltd. November 17th.

23,485. Secondary Batteries or Accumulators. J. C. A. Ward & Richard Pape, Ltd. December 3rd.

24,419. Moulded Compositions for Electrical Insulation, and the process of making the same. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 21st.

1915.

378. Electric Cable Joint Boxes and the like. A. H. Railing & C. C. Garrard. January 9th.

900. Distribution Fuseboards for Electrical Circuits. Midland Electric Manufacturing Co. & W. L. Barber. January 20th.

901. Electrical Switches. Midland Electric Manufacturing Co. & W. L. Barber. January 20th.

3,513. Electric Heating Element. Cable Accessories Co. & F. H. Reeves. March 4th. (Addition to 24,565/13.)

3,570. Electric Motor Control Systems. Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). March 5th.

5,395. Electric Batteries. H. G. C. Thofehrn. April 9th.

6,217. Wireless Telegraphy. C. M. Agner. April 26th. (June 8th, 1914.)

7,244. Means for Starting Electric Motors. G. A. Yarwood. May 14th.

8,173. Vapour Electric Rectifier Systems. British Westinghouse Electric and Manufacturing Co. June 2nd. (July 11th, 1914.)

8,203. Telephone Transmitters. P. J. Hackett. June 2nd.